TAINET

USER'S MANUAL

Ethernet over SDH

MUXpro 820/8216

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About This Manual

This section guides users on how to use the manual effectively. The manual contains information needed to install, configure, and operate the TAINET MUXpro Series NG-SDH. The summary of this manual is as follows:

Chapter 1: Overview

Introduce the main feature and modularity of MUXpro family.

Chapter 2: Installation

Provide installation, operation instructions to ensure working properly.

Chapter 3: Configuration

Detail the configuration and operation instructions.

Chapter 4: Monitoring and Maintenance

Alarm message, performance monitoring and loop testing function for diagnostic.

Appendix A: Introduction

Describe all connectors with pin definition.

Appendix B: Ordering Information

Ordering information of MUXpro Product.

Appendix C: Trouble Report Form

Allow user to submit equipment-related trouble information back to Tainet.

Appendix D: Trouble Shooting

Provide brief list of trouble shooting tips.

Appendix E: Abbreviations

Provide references for user.

Appendix F: Glossary

Appendix G: Multiplexing Structure

Appendix H: STM-1 Frame Structure

Appendix I: E1 Shape and Jitter Tolerance

Symbols Used in This Manual

3 types of symbols may be used throughout this manual. These symbols are used to advise the users when a special condition arises, such as a safety or operational hazard, or to present extra information to the users. These symbols are explained below:

Warning:

This symbol and associated text are used when death or injury to the user may result if operating instructions are not followed properly.

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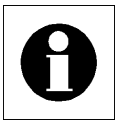

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Chapter 1. Overview

1.1 Product Overview

Muxpro Series device, a compact terminal, transports TDM and Ethernet traffic over existing SDH networks. Use Ethernet interface on SDH to plot data to multiplexer of VC-12s / VC-3s via virtual concatenation. The Muxpro Series device allows service providers to extend their network service to customer side, reducing leased lines between two demarcation points, two customer sites, or a customer site to ISP. Muxpro Series device incorporates STM-1 standard main link, accessible with 1+1 MSP/APS protection, 8 (or 16)× E1 interfaces and 6 × fast Ethernet ports. The remote unit can be managed through IP over DCC, VC12 channel and telnet. (See Figure 1-1)

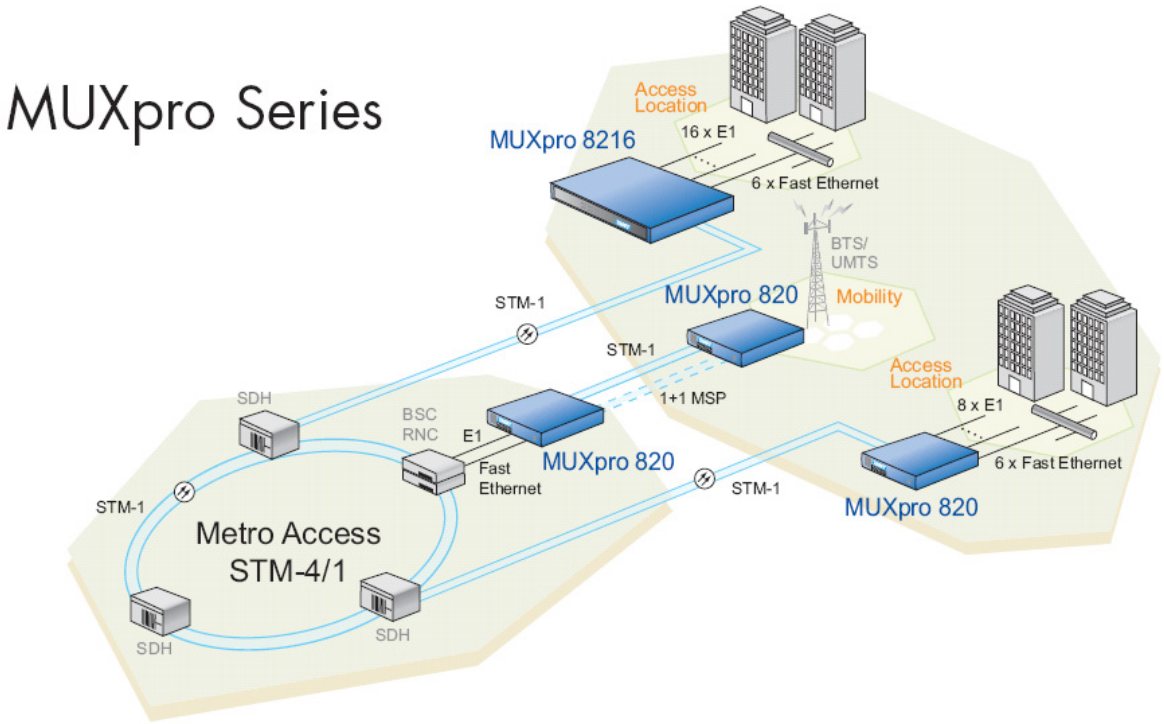


Figure 1-1 System Architecture of MUXpro Series

General Features:

- System

- Using GFP (according to G.7041) or LAPS (X.85/86) encapsulation transport Ethernet over SDH, comply with G.707
- Link Capacity Adjustment Scheme (LCAS) following G.7042 standard.
- Support VC-3/VC-12 cross connect mapping
- High order payload with virtual concatenation – mapping the Ethernet traffic over up to 1xVC-4 links
- Low order payload with virtual concatenation – mapping the Ethernet traffic over up to 63 x VC -12 / 3 x VC-3
- GFP MUX, groom multiple Ethernet ports traffic into different bundles of Virtual Containers (up to 6 bundles), according to a predefined group
- Ethernet Line-Service (Point to Point) and Ethernet LAN-Service (Multipoint to Multipoint)
- System clock synchronization from primary internal clock; secondary clock from STM-1 or tributary
- Configurable through user friendly Web-Interface
- Manage remote unit via dedicated VC-12 channel or DCC channel
- Selectable DCC channels: D1~D3, D4~D12, D1~D12

■ Layer 2 Bridge / Switch Mode

- Support bridge function for LAN1~LAN4
- IGMP snooping
- Spanning Tree Protocol (STP IEEE 802.1D) and status monitoring
- QoS (VLAN or DSCP selection) via four priority queues, supporting IEEE 802.1P, IPv4 TOS / DiffServ
- Provide port-based VLAN, 802.1Q VLAN tagging up to 64 VLAN IDs
- Switch mode supports Ethernet packet length up to 1536 bytes

■ Transmission Mode

- 8 E1 links + 6 Fast Ethernet

■ Interfaces

- STM-1 Interface:

- Number of ports: 2, 1+1 MSP protection available
- Framing: SDH
- Bit Rate: 155.520Mbps
- Jitter Performance: compliant with ITU-T G.783
- Optical Wavelength: 1310nm
- Optical output power: -6dBm
- Receiver sensitivity: -34dBm
- Connectors: SC or FC/PC

□ LAN Interface:

- Number of ports: 6
- Port 1 to 4 support VLAN while Port 5 and 6 do not
- Ethernet Type: 10/100 Base T, auto sensing/auto negotiation
- Compliance Protocol: IEEE802.3u, 802.3x
- Connectors: shielded, RJ45.

□ ITU-T G.703 E1 Interface:

- Number of ports: 8 or 16
- Line Rate: 2.048Mbps
- Line Coding: HDB3
- Jitter Performance: compliant with ITU-T G.823, see Appendix I.
- Connector: SCSI II, female

■ Timing Source Setting:

□ Provide internal, optical 1, and optical 2, E1 Tributary clock source as system clock

□ Recovered clock from STM-1 interface, auto switching in auto mode

□ External clock from E1 tributary (2048Kbits/sec)

■ Diagnostic Function:

□ Local loopback from SDH or E1 side

- Remote loopback from SDH or E1 side
- PRBS Pattern Test for E1 ports only(error rate <1 in 10^{12}bit)
- Local loopback from Ethernet side

■ Management

- Easy to use Web UI configuration management
- SNMP v2 with Tainet UNMS
- Provide 5 SNMP trap IPs and read/write/trap community settings
- Support configuration upload/download and firmware update

■ Dimensions and Operating Environment

- MUXpro 820 =>210mm (W) x 285mm (D) x 41 mm (H)
- MUXpro 8216 => 437mm (W) x 287mm (D) x 44 mm (H)
- Operation temperature: 0^0C ~ 50^0C
- Storage temperature: -25^0C ~ 70^0C
- Relative humidity: up to 95% (non-condensing)

■ Power Requirement

- MUXpro 820 =>AC: 110V~240 $\pm$10V, 50~60$\pm$3Hz; DC: -36V ~ -72V
- MUXpro 8216 =>AC: 110V~240 $\pm$10V, 50~60$\pm$3Hz: DC: -36V ~ -72V (AC+DC / DC + DC)

Table 1-1 General Features of MUXpro Series Product

	M820	M8216
Cross- Connection Capacity	Up to 8 E1	Up to 16 E1
Management Interface	Craft port: VT-100 terminal Ethernet: WEB UI/Telnet/ SNMP	Craft port: VT-100 terminal Ethernet: WEB UI/Telnet/ SNMP
SNMP Management	Built-in SNMP Agent; In-band management via DCC; Out-band management via Ethernet	Built-in SNMP Agent; In-band management via DCC; Out-band management via Ethernet
Firmware Upgrade	By TFTP	By TFTP
On-Board I/O Interfaces	8 ports E1 Interface; Short haul configurable; 75/120 Ohms configurable	8 ports E1 Interface; Short haul configurable; 75/120 Ohms configurable
Number of I/O Slots	N/A	1
Plug-in I/O Module	N/A	1 for tributary E1
Hot Swappable I/O Modules	Not Supported	Tributary E1
Power Supply	AC: 110V~240V, 50~60Hz; DC: -36V ~ -72V;	AC: 110V~240$\pm$10V, 50~60$\pm$3Hz; DC: -36V ~ -72V; (AC+DC; or DC+DC)
Dimension	210mm(W) x 285mm(D) x 41mm(H)	437mm(W) x 287mm(D) x 44mm(H)
Environment	Operation temperature: 0^0C~ 50^0C Storage temperature: -25^0C ~ 70^0C Relative humidity: up to 95% (non-condensing)	Operation temperature: 0^0C~ 50^0C Storage temperature: -25^0C ~ 70^0C Relative humidity: up to 95% (non-condensing)

1.2 Main Features

1.2.1 Network Interfaces

The MUXpro Series device is accessible with one of the following types of networking interfaces:

- Intra-office electrical STM-1 interface
- Optical interfaces. A wide range of various optical interface options is available for the MUXpro Series, supporting long-haul/short-haul applications; Single-link MUXpro Series supports the MSP 1+1 physical layer protection mechanism.

As part of the SDH network, the optical line transmission subsystem provides high quality, excellent availability and good performance that can monitor the traffic path down to the customer premises.

1.2.2 LAN Ports

All the 10/100BaseT LAN ports support auto-negotiation for plug-and-play Ethernet connectivity. Alternatively, the user to operate at the preferred rate and mode can configure each port separately.

The services provided by the various ports are showing as follows:

- The Ethernet ports 1 to 4 are served by a built-in Ethernet switch with support for QoS, in full compliance with the IEEE 802.3u, 802.3x standards. The switch supports port-based and IEEE 802.1Q tag-based VLANs, with configurable characteristics on a per-port basis. The switch operates in the IEEE 802.1Q that is shared VLAN learning mode (SVL); it means that any MAC address learned in one VLAN is also used for forwarding decision affecting the address in the other defined VLANs (the total number of VLANs that can be defined is 64). The device supports double tagging.

  The Ethernet switch supports up to four independent WAN ports (groups), where each WAN port can be connected to any preferred combination of virtually concatenated groups. The algorithm that is used for frame forwarding can be configured in accordance with the application requirements:

  - Bridge only

- Bridge and Spanning Tree Protocol (STP)

When the MUXpro is equipped with 6 LAN ports (4 ports with Ethernet switch and 2 transparent ports), the total number of virtually concatenated groups supported by the MUXpro is 6.

1.2.3 Handling the Ethernet Traffic

The Ethernet traffic is encapsulated for transmission via SDH network using one of the following link-layer protocols:

- Generic Framing Procedure (GFP) in accordance with ITU-T Rec. G.7041, framed mode, including support for GFP multiplexing
- Link Access Procedure for SDH (LAPS) protocols – per ITU-T Rec. X.85/X.86 draft recommendations.

The six traffic groups from the Ethernet switch are mapped into SDH containers using virtually concatenated groups. Mapping is flexible, and enables using any combination of virtually concatenated groups.

Unlike the traffic from the Ethernet switch, which can be switched along with predefined VLAN groups to various virtually concatenated VCs, the Ethernet traffic from the two transparent ports are always connected to a fixed group (port 5 to group 5, etc.).

The fraction of network-linked bandwidth allocated to each virtually concatenated group can be configured. Besides, LCAS can be used on any virtually concatenated group with more than one VC to increase or decrease the capability in accordance with the diverse application requirements, and remove component VCs that failed.

1.2.4 E1 Ports

The E1 ports of the MUXpro have selectable balanced or unbalanced copper interfaces per ITU-T Rec. G.703, with support for short-haul applications. The ports support unframed E1 streams in compliance with ITU-T Rec. G.703. Each E1 port provides two indications: loss of signal (LOS) and AIS.

The E1 multiplex structure is VC-12, TU-12, TUG-2, TUG-3, or AU-4 where each E1 port can be placed in any VC-12 inside the STM-1 bandwidth.

1.2.5 Management Support

Using one of the following methods can perform setup, control and monitor the status and diagnostics information:

- ASCII terminal connected to the V.24/RS-232 craft port
- Telnet host, Web browsers and SNMP-based network management stations The following access options are supported:
  - Out-of-band access via one of the LAN ports connected to the internal Ethernet switch (that is, Ethernet ports: 1, 2, 3 and 4)
  - In-band access either through the SDH network, through one of the VCG ports of the internal Ethernet switch, or through the DCC carried in the STM-1 link overhead.

The management subsystem supports TFTP for remote software upgrading downloading, as well as cold software downloading by using an ASCII terminal directly connected to the MUXpro Series Device. TFTP can also be used to upload and download the MUXpro configuration database. Network administrators can use the download facility to allocate confirmed configuration files to all the managed MUXpro units in the network from a central office (CO).

To further expedite the process, it is also possible to upload the configuration data stored by a MUXpro unit to the management station as a standard disk file, and then dispense the file to other units that use the similar configuration.

MUXpro has comprehensive diagnostics capabilities including: real-time alarms alert users to fault conditions. Alarms are reported to the management station and simultaneously relayed via ALARM port Ethernet and SDH link monitoring.

1.3 Technical Specification

1.3.1 Electrical Characteristics

The on board E1 interfaces for MUXpro Series refer to ITU-T G.703 (Physical / electrical characteristics of hierarchical digital interfaces).

Table 1-2 Electrical Characteristic of E1

Bit rate	2.048 Mbps ± 50ppm
Line code	HDB3
Pulse shape	Meet G.703, see Appendix I
Peak voltage of mark	2.37V± 10%(75Ω) 3V± 10% (120Ω)
Peak voltage of space	0±0.237V(75Ω) 0±0.3V(120Ω)
Pulse width	244ns± 25ns
Ratio of amplitude	0.95 to 1.05
Ratio of width	0.95 to 1.05
Output jitter	Refer to G.823, see Appendix I
Input attenuation	Attenuation ≥6db at 1024kHz
Jitter tolerance	Refer to G.823, see Appendix I
Jitter transfer	Refer to G.823, see Appendix I
Wander	Refer to G.823, see Appendix i
Return loss	51 kHz~102 kHz ≥12dB / 102 kHz~2048 kHz ≥ 18db / 2048 kHz~3072 kHz ≥ 14dB

The on board Ethernet interface for MUXpro Series refers to IEEE-802.3 (Carrier sense multiple access with collision detection access method and physical-layer specification) with RJ-45 connector.

Table 1-3 Electrical Characteristic of Ethernet

Output impedance	5~10 MHz, 85Ω ~111Ω
Return loss	5~10 MHz >15db
Impedance balance	~20Mhz < 29 - 17log(5/10)
Common mode output voltage	<50mV
Differential mode output voltage	See 802.3 14-1(pulse template)
Input impedance	5~10Mhz 85Ω~111Ω
Transmission length	100m
Ratio Isolated resistor	>2MΩ
Leakage current	At 1.5kv <10ma

1.3.2 Timing Control

There are four different methods for timing control: Internal Clock, Hold-over, Clock Mode Switch Automatically, and STM-1 Line Clock Source.

1.3.3 Operation Environment

- Temperature: Humidity:
  - Storage: -25ºC ~ 70ºC 95% non-condensing
  - Operation: 0ºC ~ 50ºC 95% non-condensing

1.3.4 Power Requirement

- MUXpro 820:
  - DC: -36 ~ -72V
  - AC: 110 ~ 240±10V, 50 ~ 60±3Hz
- MUXpro 8216:
  - DC: -36 ~ -72V
  - AC: 110 ~ 240±10V, 50 ~ 60±3Hz
  - AC+DC, DC+DC

1.3.5 Power Consumption

Maximum Power Consumption of MUXpro Series for all modules fully loaded

- MUXpro 820:
  - DC:15W AC:26W
- MUXpro 8216:
  - DC:19W AC:27W

1.3.6 Electromagnetic Specification

- EN 55022: 1998+A1: 2000+A2: 2003 Class A

1.4 Typical Applications

1.4.1 Applications for MUXpro

Figure 1-2 shows a typical application for MUXpro. In this application, MUXpro units provide links to carry the LAN traffic among numerous sites, and enable efficient access to IP networks (Internet or enterprise intranets). The links are provided via the SDH network.

The advanced Ethernet switch of the MUXpro enables a variety of flexible routings of traffic among the various sites. For example, using suitably configured port-based VLANs enhances authoritarian security; furthermore, using tag-based VLANs enables both segregation of user's traffic in accordance with its source and control over the quality of service (QoS) for each type of traffic.

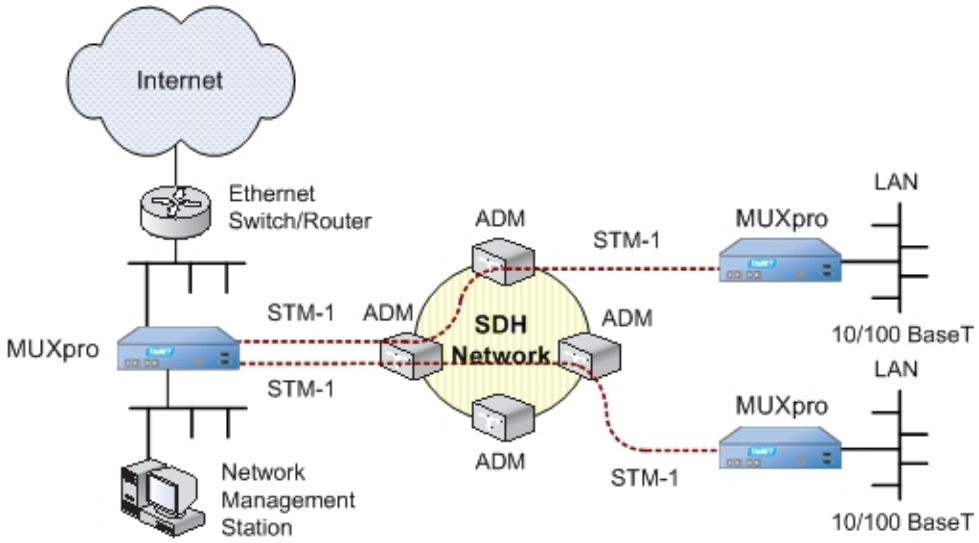


Figure 1-2 Typical Applications for MUXpro Series device

The whole network can be managed from a single location, using an SNMP-based network management station that is connected to one of the MUXpro units. To avoid using link payload-carrying capacity, the management traffic can be carried within the SDH overhead, using the DCC.

Note:

The DCC can only be used when the SDH network supports access and enables transparent connection to the DCC at the required locations.

1.4.2 Applications for MUXpro with 2 transparent LAN ports

Figure 1-3 shows a typical application for a MUXpro unit equipped with 6 LAN ports (4 LAN ports connected to the internal Ethernet switch and 2 additional transparent LAN ports). The user can select the number of transparent LAN ports that are actually used (enabled).

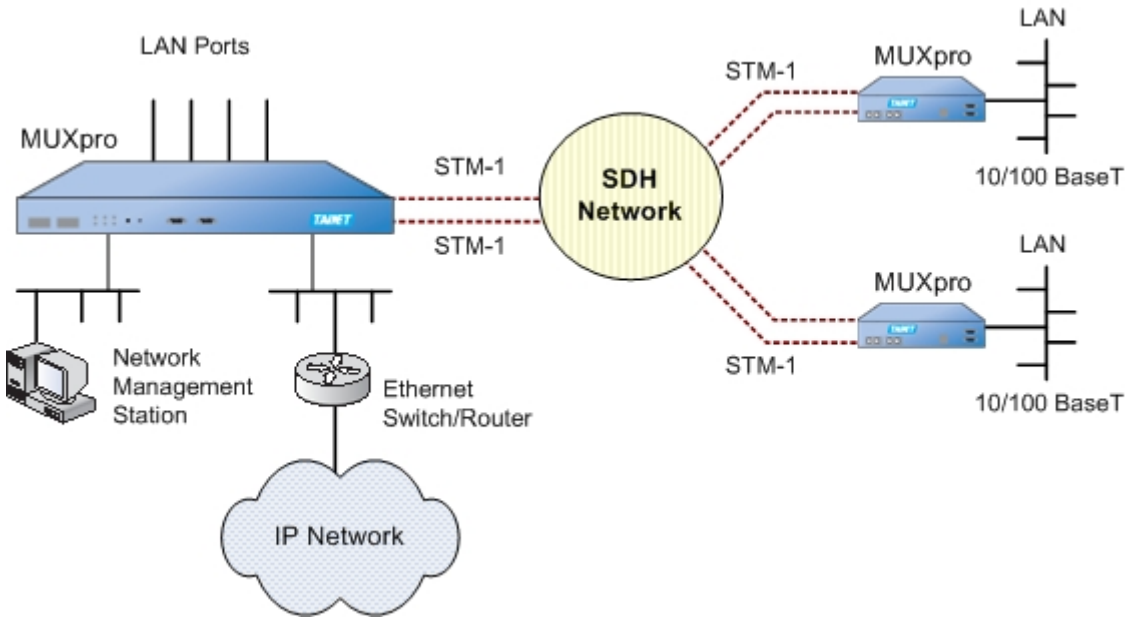


Figure 1-3 Typical Applications for MUXpro with Transparent LAN Ports

Typically, each transparent LAN port can be used to serve a specific application, or a division within a larger enterprise.

The traffic passing through each transparent LAN port is routed to a specific virtually concatenated group (port 5 – to group 5, port 6 – to group 6, etc.). It means that each transparent LAN port can be independently routed through the SDH network, and each port can be allocated exclusive access to a user-selected fraction of the link bandwidth as well.

The traffic from each LAN port is transparently transported across the SDH network, with no processing except encapsulation (LAPS or GFP). Therefore, the MUXpro link serves as a LAN extender; it indicates that a user-provided router or Layer 2 switch must be used when it is essential to avoid local traffic from flowing to the remote site through the SDH network.

1.4.3 Applications for MUXpro with E1 interfaces

Figure 1-4 shows a typical application for a MUXpro unit equipped E1 interfaces. MUXpro provides a well-developed solution for all the internal communication requirements of various businesses.

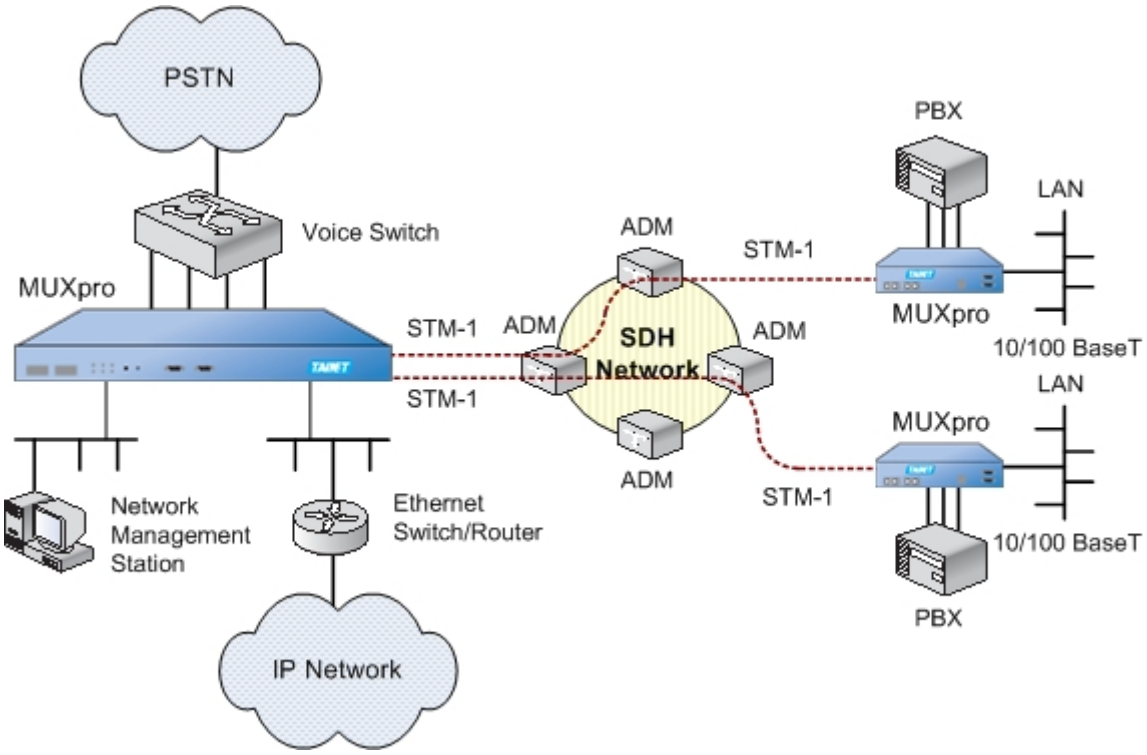


Figure 1-4 Typical Applications for MUXpro Unit with E1 Interfaces

MUXpro Devices provide the broadband connectivity for both voice and LAN services between the headquarters and the branch offices. For example:

The headquarters' voice switch is connected to the MUXpro E1 interfaces. Its traffic is transparently transported over the network to each branch office. Separated trails can be defined for the connection to the PBX of each branch office. Moreover, the branch offices can also be connected to the PSTN through headquarters' voice switch, irrespective of their geographical location. The total bandwidth need is one VC-12 per E1 trunk that means most of the STM-1 link bandwidth is free to carry LAN traffic.

Additionally, the remained bandwidth can be used to carry broadband LAN traffic, and the management.

1.5 Physical Description

1.5.1 General Description

Figure 1-5 and Figure 1-6 shows a general outlook of a typical MUXpro 820 Unit. MUXpro 820 is a compact unit, intended for installation in half 19” racks, on desktops or shelves. The unit height is 1U (1.75 in). An optional rack-mount adapter kit enables installing two MUXpro 820 units, side by side, in a 19-inch rack.

The MUXpro 820 front panel also includes indicators that represent its operating status.

Figure 1-5 MUXpro 820 Front Panel

Figure 1-6 MUXpro 820 Rear Panel

Figure 1-7 and Figure 1-8 shows a general outlook of a MUXpro 8216 unit. MUXpro 8216 is a compact unit, intended for installation in full 19” racks, on desktops or shelves. The unit height is 1U (1.75 in).

The MUXpro 8216 front panel also includes indicators that represent its operating status.

Figure 1-7 MUXpro 8216 Front Panel

Figure 1-8 MUXpro 8216 Rear Panel

1.6 Functional Description

The MUXpro includes the following main subsystems:

- Network interface subsystem, comprising:
  - SDH framer subsystem
  - Network link interfaces
- LAN port subsystem, comprising:
  - LAN interfaces
  - Ethernet switch
  - Ethernet mapper for groups 1 to 6
- E1 subsystem, comprising:
  - E1 interfaces
  - Mapper
- Timing subsystem
- Management subsystem
- Power supply subsystem.

1.6.1 Network Subsystem Interface

1.6.1.1 SDH Framer Subsystem

The SDH framer subsystem for the network interface provides the frame assembly/disassembly services and SDH overhead processing for the link to the network: Furthermore, The operating mode of the mapper is determined by the network interface installed on the MUXpro.

The Ethernet and E1 mappers determine the position of the various VCs within the link frame.

1.6.1.2 Optical Interfaces for Network Link

The MUXpro can be ordered with two STM-1 ports. The ports are optimally meet customer's requirements with a standard form. There are three necessarities within the optical interface: optical wavelength is 1310nm, optical output power is -6dBm and receiver sensitivity is -34dBm, MUXpro Series with two network ports support line protection, i.e., at any time, only one port is active and the other is in standby. The protection is implemented by means of the standard multiplex section protection (MSP 1+1) physical-layer protection mechanism, which allows the service to the customer to be protected against link failure. The ports may be ordered with SC or FC/PC connectors.

1.6.2 LAN Port Interfaces

1.6.2.1 Basic LAN Port Interfaces

The MUXpro has four identical LAN ports, LAN 1, LAN 2, LAN 3 and LAN 4 with

10/100BaseT Ethernet interfaces for connection to user's LANs. These ports are connected to the Ethernet switch subsystem.

Each Ethernet interface supports auto-negotiation. The user can configure the advertised data rate (10 or 100 Mbps) and operating mode (half-duplex or full duplex).

Alternatively, auto-negotiation can be disabled and the rate and operating mode be directly specified.

Each port is terminated in an RJ-45 connector, wired as a hub port. The interface includes automatic polarity and crossover detection and correction. Therefore, it can always be connected through a "straight" (point-to-point) cable to any other type of 10/100BaseT Ethernet port (hub or station).

1.6.2.2 Transparent LAN Port Interfaces

The transparent LAN ports, LAN 5 and LAN 6, have the same type of interfaces as the basic LAN ports. The only difference is that the transparent ports connect directly to the encapsulation function, and are connected to fixed virtually concatenated groups (LAN 5 to group 5, and so on up to group 6 for LAN 6).

1.6.3 Ethernet Switch Subsystem

1.6.3.1 Ethernet Switch Description

The MUXpro includes an Ethernet switch with VLAN support that fully complies with the IEEE 802.3/Ethernet V.2 standards, has user-selectable forwarding algorithms, and provides extensive support for QoS features. The switch has memory-based switch fabric with true non-blocking switching performance(for 100Mb/s speed, 64byte frame, 148800pps throughput).

The switch collects a wide range of performance monitoring parameters, which can be read by management. The Ethernet switch has seven ports:

- Four external ports, connecting to LAN 1 LAN interface, LAN 2 LAN interface, LAN 3 LAN interface and LAN 4 LAN interface respectively.
- Four VCG groups. These ports connect to the encapsulation function, part of the Ethernet mapper subsystem, which processes the traffic for transmission via SDH network using virtual concatenation. Each port connects to one of the virtually concatenated groups 1 and 4.
- Management port, connected internally to the MUXpro management subsystem.

An independent MAC controller that performs all the functions required by the IEEE 802.3 protocol supports each port.

The frames passed by the MAC controller are analyzed by the ingress policy controller of the corresponding port before being transferred to an internal queue controller, which controls the frame egress priorities and inserts them in four separate queues. The queues are connected to the ports through the port egress policy controllers. This approach provides full control over traffic flow, and ensures that congestion at one port does not affect other ports.

1.6.3.2 Flow Control Options

The user can enable flow control for the switch ports. When flow control is enabled, it is always activated only on the port (or ports) involved in congestion; on the contrary, other ports are not affected.

Flow control is available in both the half-duplex and full-duplex modes:

- In the half-duplex mode, flow control uses a collision-based scheme to throttle the connected stations when the free buffer space of the corresponding port is too low, to avoid discarding frames during network congestion (this approach is called back pressure). When the buffer space of a port is almost full, its MAC controller forces a collision in the input port when an incoming frame is sensed (the alternative, without flow control, is to discard the incoming frame).
- In the full-duplex mode, the standard flow control method defined in IEEE 802.3x is used, which is based on pause frames and enables stopping and restoring the transmission from the remote node. However, this method can only be used when auto-negotiation is enabled on the port, and the node attached to the port supports pause frames.

The Ethernet switch internal MAC controllers discard all the received IEEE 802.3x pause frames, even when full-duplex flow control is disabled or the port is in the half-duplex mode.

1.6.3.3 Forwarding Algorithms

The Ethernet switch operates as a MAC bridge, that automatically learns the MAC addresses located on the local LAN, and the port through which frames addressed to a foreign destination are to be transmitted.

The Ethernet switch LAN table can store up to 1024 MAC address/port number mappings. Only active MAC address/port number mappings are actually stored; after a user-defined aging interval, inactive mappings are removed from the switch memory. However, the user can also add static entries, which are not automatically removed.

When used in more complex networks, the forwarding algorithm can be extended to include Spanning Tree Protocol (STP), where the user can select between the basic STP versions. The selection is separately made for each switch port.

The user can also select the STP parameters, which are used in common by the whole switch, to fine-tune the performance. To help locating forwarding problems, the user can read the STP algorithm status and current parameter values.

1.6.3.4 VLAN Support

The Ethernet switch can use VLAN information to select the ports among which traffic can be forwarded. There are two basic methods:

- Port-based VLANs. See description in the Support for Port-Based VLAN section below
- Tag-based VLAN switching per IEEE 802.1Q. This mode is used to handle traffic in accordance with user-defined forwarding rules that are based on the IEEE 802.1Q tags of the frames. For the external LAN ports (LAN 1, LAN 2, LAN 3 and LAN 4), the user can also select whether to discard untagged frames, or process them.

See description in the Support for 802.1Q Tag-Based VLAN Switching section below. MuxPro series also support double tagging.

Note:

The user can configure, for each port, whether it will participate in a port-based VLAN or will use 802.1Q tag-based switching. However, a port configured to use 802.1Q tag-based switching may still be included in a port-based VLAN, where it will serve as egress port for other ports in the same VLAN.
The switch operates in the IEEE 802.1Q SVL mode.

1.6.3.5 QoS Support

The switch provides support for quality-of-service (QoS) features. Four traffic classes are supported, where each class is typically assigned to a type of prioritized frame stream.

The user can specify the QoS criteria from one the following options (or alternatively, can disable the QoS functionality):

- Priority determined in accordance with the VLAN ID; for identical VLAN IDs, the priority is determined by the frame DSCP field (the Differentiated Services Code point, specified in RFC2474).
- Priority determined in accordance with the DSCP value, and for identical DSCP values, by the VLAN ID.
- Priority determined only by IEEE 802.1p VLAN tag.
- Priority determined only by the RFC2474 DSCP value.

For more information regarding the use of VLAN tags, see the Support for 802.1Q Tag-Based VLAN Switching section below.

Note:

As an alternative to using the information carried by each frame to determine the QoS during its forwarding by the switch, the user can assign a fixed priority to any port. Therefore, when the QoS feature is not enabled, the egress priority of any frame received through a certain port is determined only by the user-configured priority of the frame ingress port. This fixed priority can be independently selected for each port.

The switch also enables the user to configure the egress scheduling mode:

- Strict priority mode: all top priority frames are egressed out of a port until that priority's queue is empty, then the next lower priority queue's frames are egressed. In other words, whenever a queue has a frame to transmit, it goes out to the link before any frame in any lower-priority queue.

The strict priority mode guaranties minimum latency for the traffic assigned to a queue, but can cause the lower priority queues to be starved out, because it may prevent them from transmitting any frames, but on the other hand ensures that all the high priority frames egress the switch as soon as possible.

- Weighted fair queue mode: 8, 4, 2, 1 weighting is applied to the four priorities. This approach prevents the lower priority frames from being starved out with only a slightly increased delay to the higher priority frames.

However, only idle bandwidth is used for lower priority frames: to ensure that the bandwidth assigned to a certain traffic class does not decrease below the assigned value, when congestion occurs any class cannot more than the assigned bandwidth.

1.6.3.6 Support for Port-Based VLAN

The Ethernet switch supports user-defined port-based VLANs. A port-based VLAN is a logical group of ports defined by the user: traffic within the VLAN is forwarded

only to the VLAN member ports. Therefore, in addition to their functional value as tools for controlling traffic flow; port-based VLANs are an important security tool.

The Ethernet switch enables defining port-based VLANs that include any of its four VCG Groups (which are connected to user-defined virtually concatenated groups in the range of 1 to 4), as well as the port connecting to the MUXpro management subsystem.

However, any VLAN can include only one external LAN port out of the four connected to the Ethernet switch, that is, LAN 1, LAN 2, LAN 3 or LAN 4. Therefore, traffic received through one of these ports cannot reach the other port, although it can be forwarded through any desired group connected to the switch, and/or to the internal management port.

See Figure 1-9, which illustrates the functionality of the two port-based VLANs that are defined in the MUXpro factory-default configuration:

- One port-based VLAN, designated VLAN Port 1, includes the MUXpro external port designated LAN 1, the management port, and groups 1 and 3
- The other port-based VLAN, designated VLAN Port 2, and includes the MUXpro external port designated LAN 2, the management port, and groups 2 and 4.

The factory-default configurations described above must ensure that the management subsystem can communicate through the external LAN ports LAN 1 and LAN 2, and through any of the virtually concatenated groups 1 to 4.

Note:

The factory-default configuration has been designed to separate between even and odd groups, but this is an arbitrary decision: an external port can connect to any, or all of the virtually concatenated groups connected to the Ethernet switch ports.

The maximum number of port-based VLANs that can be defined is 20. For convenience, the user can also assign a logical name to each VLAN.

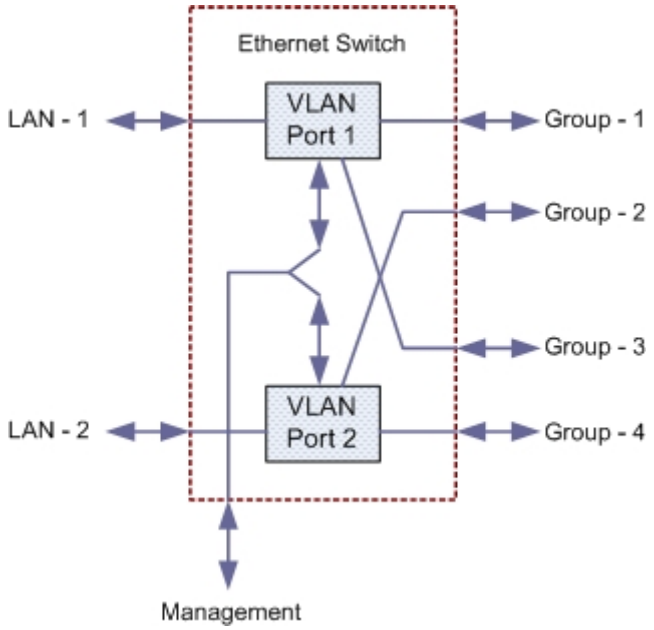


Figure 1-9 Example of Port-Based VLAN Function

1.6.3.7 Support for 802.1Q Tag-Based VLAN Switching

VLAN tags carry additional information that can be used to identify VLAN membership and priority. Such tags can therefore be used to differentiate among a variety of traffic in accordance with the VLAN number (identifier – ID) and priority (preferred QoS).

The information needed to specify the handling of frames in accordance with their VLAN ID is given in a VLAN switching table, which contains the forwarding rules. One rule must be defined for each VLAN ID to be processed: any frame with VLAN Ids not appearing in the table is ignored (discarded upon ingress). The maximum number of rules that can be defined is 64.

A forwarding rule specifies two types of information:

- The ports that participate in the forwarding of frames with the corresponding VLAN ID. Any rule can include a single external (LAN) port – LAN 1 or LAN 2. Rules must also be defined to include VLANs switched only among VCG groups, and for the management VLAN, when management VLAN tagging is enabled.
- The handling of frame tags. The available selections include:
  - Unmodified: the port transfers the tags of the frames forwarded to it without any change. Therefore, untagged frames egress the port as untagged frames, and tagged frames egress the port as tagged frames.

This mode is available for both the external LAN ports (LAN 1 and LAN 2), and for virtually concatenated groups 1 to 4.

- Untagged: all the frames egress the port as untagged frames. Therefore, untagged frames egress the port unmodified, whereas tagged frames are converted to untagged frames before egressing the port (this is performed by removing their tag and recalculating the frame CRC). This mode is available only for the virtually concatenated groups 1 to 4.
- Tagged: all the frames egress the port as tagged frames. Therefore, tagged frames egress the port unmodified, whereas untagged frames are converted to tagged frames before egressing the port (this is performed by adding a tag with the VLAN ID which is defined for the corresponding port, and recalculating the frame CRC). This mode is available only for the virtually concatenated groups 1 to 4.
- Double tagged: a tag is always added to all the frames that egress the port. This mode can be used only when the network supports a frame size of at least 1526 bytes.

1.6.4 Ethernet Mapper Subsystem

The Ethernet mapper subsystem manages all the functions that are related to the use of virtual concatenation, and the preparation of LAN traffic for efficient transport via the SDH network.

The subsystem includes the following functions:

- LAPS encapsulation
- GFP encapsulation
- Group mapper
- GFP multiplexer

MUXpro unit also supports the Link Capacity Adjustment Scheme (LCAS), covered by ITU-T Rec. G.7042.

1.6.4.1 Encapsulation Functions

Ethernet frames must be encapsulated before transporting over the SDH network.

Two types of encapsulation are supported:

- LAPS (Link Access Protocol – SDH) encapsulation in accordance with ITU-T Rec. X.86
- GFP (Generic Framing Procedure) encapsulation in accordance with ITU-T Rec. G.7041, using the framed mode. mapped into G.707 VC payload.

The user can select the preferred encapsulation mode, separately, for each virtually concatenated group. The encapsulation parameters can also be configured, for best performance in specific applications.

The encapsulated frames of each group are applied to the corresponding group mapper.

1.6.4.2 Group Mapper Functions

The group mappers plot the LAN traffic for transmission over the SDH network.

The mappers also create the virtually concatenated groups that enable the user to control the utilization of the bandwidth available on the link to the SDH network.

Note:

For compatibility with equipment from other vendors, the user can configure the group mappers to simulate the use of virtual concatenation even when the group includes a single virtual container.

The mapper serving the Ethernet switch can manage up to four groups (these are always groups 1 to 4).

Link bandwidth utilization is configured within two steps:

- Define the bandwidth allocated to each group: selecting the type and the number of VCs allocated to each group makes this. The bandwidth is allocated using virtual concatenation.

  Following are several examples of bandwidth allocation enabled by virtual concatenation:

- When using VC-3: the maximum of two virtually concatenated groups per MUXpro. For example, a group using two VC-3s can be used to carry the maximum traffic load of a 100Base-TX Ethernet port.
- When using VC-12: the 63 VC-12s can be divided as required to create up to 6 groups. For example, a group using 5 VC-12 can be used to carry the full traffic load of a 10BaseT Ethernet port over SDH.

It is allowed to build virtually concatenated groups using different types of

VCs: for example, when using VC-12 to carry E1 traffic, one or two groups can use VC-3s, and the remaining bandwidth (17 VC-12) can be assigned to one or two additional virtually concatenated groups.

- Route the groups. The routing is defined by any means of mapping (mapping is the selection of specific VCs to be used to carry each group, the number needed to carry the bandwidth selected in Step 1 showing above).

This operation creates the trails that are needed to connect the local users to remote locations via the SDH network.

1.6.4.3 Support for LCAS

Each virtually concatenated group with two or more VCs can be configured to support LCAS. With LCAS, the capability of a virtually concatenated group can be decreased when one of the VCs get failed; when the failure no longer appear, the group will automatically recover and return to the normal capability.

The user can configure diverse LCAS protocol parameters, and can also specify a minimum number of VCs for the group capacity; if the number of VCs decreases below this minimum, an alarm will be generated.

1.6.4.4 GFP Multiplexer Function

Virtual concatenation provides the means to transport payloads at rates that differ from those are available in the standard SDH hierarchy. Therefore, virtual concatenation is always used by the MUXpro to carry the LAN traffic (unless a single VC is used).

Although virtual concatenation leads to improved utilization of available bandwidth, better utilization would be achieved by taking into consideration the statistical allocation of traffic generated by multiple Ethernet nodes, and reserving bandwidth only for the average load. The capability is provided by the MUXpro GFP

multiplexer function.

Note:

To use GFP multiplexing, all of the multiplexed groups must use GFP encapsulation.
Groups not connected to the GFP multiplexer may use LAPS encapsulation.

To use GFP multiplexing, the groups to be multiplexed are routed, after GFP encapsulation, to the multiplexer, instead of directly to the group mapper.

Specifically, all the virtually concatenated groups to be multiplexed must use the same type of VCs.

The GFP multiplexer is configured as follows:

- Selection of the virtually concatenated groups to be multiplexed.

  For a MUXpro with six LAN ports, the maximum number of virtually concatenated groups is 6; therefore, 2 multiplexing options (referred to as GFP multiplexers) are available:

  - One multiplexing group of at least one virtually concatenated group and the maximum is up to six virtually concatenated groups. All these groups must use the same type of VCs.

- Allocation of bandwidth guaranteed to each multiplexed group, in 16.67% increments.

- Assignment of an individual channel identifier (ID) to each group.

- Selection of the primary group. The primary group is the only virtually concatenated group that is actually mapped as a regular virtually concatenated group (as explained in the Group Mapper section above, the mapping defines the bandwidth and routing within the SDH network).

Therefore, by specifying the primary group bandwidth in Step 2 above you actually specify the bandwidth that is allocated to the multiplexed stream. The bandwidth guaranteed to each of the other multiplexed groups (referred to as secondary groups) is the calculated as the fraction of the primary group bandwidth.

Note:

Only secondary groups that are not mapped can be connected to a GFP multiplexer. For convenience, when a group is added as secondary group to a GFP multiplexer, its encapsulation mode is automatically changed to GFP.

The GFP multiplexer output is managed by the group mapper, instead of the member groups (the member groups are not connected to the mapper). The mapper output is then inserted into the SDH frames in reference to the mapping defined for the primary group.

The main advantage of GFP multiplexing is the way bandwidth allocation is handled:

- The minimum bandwidth provided to any multiplexed group is guaranteed; it is always the fraction of primary group bandwidth specified in Step 2.
- If temporarily one of the member groups does not utilize the guaranteed bandwidth, for example, because of low traffic load, the unutilized bandwidth is used to carry the traffic of the other groups. Therefore, no bandwidth is wasted if another user requires it.

The use of GFP multiplexing does not detract in any way from the security conferred by the uses of port-based VLANs; moreover, only the end points at which the GFP multiplexing/de-multiplexing taking place are aware of the multiplexed group structure.

1.6.5 E1 Interface Subsystem

1.6.5.1 E1 Ports

MUXpro operating in SDH networks can be equipped with eight or sixteen independent E1 ports, which depends on the product model. MUXpro 820 has 8 independent E1 ports and MUXpro 8216 has 16 independent E1 ports. The ports process the signals as unframed streams.

The E1 interfaces support 120Ω balanced line interface which are terminated in SCSI II, female connector, with nominal transmit level of ±3V and also support 75 Ω unbalanced interface, with nominal transit level of ±2.37V

1.6.5.2 Bandwidth occupied by E1 Traffic

When some of the bandwidth is assigned to E1 traffic, it reduces the number of VC-12s available for carrying Ethernet traffic.

The reduction in bandwidth available for LAN traffic is as follows:

- MUXpro 820: the number of VC-12s will be reduced by 8, form 63 to 55 if full E1 is assigned.
- MUXpro 8216: the number of VC-12s will be reduced by 16, form 63 to 47 if full E1 is assigned.

1.6.6 Mappers for E1 Subsystem

The functions provided by the mappers serving the various E1 interface options are described below. The multiplexing structure is as Appendix G.

1.6.6.1 Functions of E1 Mapper for SDH Network Interface

The E1 mapper enables mapping the data stream of each E1 port to any of the 63 VC-12 in the STM-1 signal.

To enable rapid service start-up, default mappings are used:

- When no groups are used, the signal from each E1 port is inserted in the VC-12 with the same number, that is, E1 port No. 1 is inserted in VC-12 No. 1, E1 port No. 2 is inserted in VC-12 No. 2, etc.
- When groups are used, the groups are mapped first, followed by the E1 ports, in the following order:
  - All the defined groups (starting with the group 1 and up the maximum defined) are assigned the first VC-12s
  - The signal from the E1 port is inserted in the first free VC-12 after the last VC-12 assigned to a group, and so on.

In most applications, these defaults need not be changed:

- When the MUXpro operates as a terminal multiplexer, which connects to the transport backbone through an ADM, the ADM can always be configured to perform any cross-connection that may be required.

- In a point-to-point connection between two MUXpro, the only reason to change the defaults is to adapt the MUXpro to change in the original utilization of its ports.

1.6.7 Timing Subsystem

1.6.7.1 SDH Timing Subsystem for MUXpro with E1 Ports

MUXpro 82xx Clock Selection Diagram:

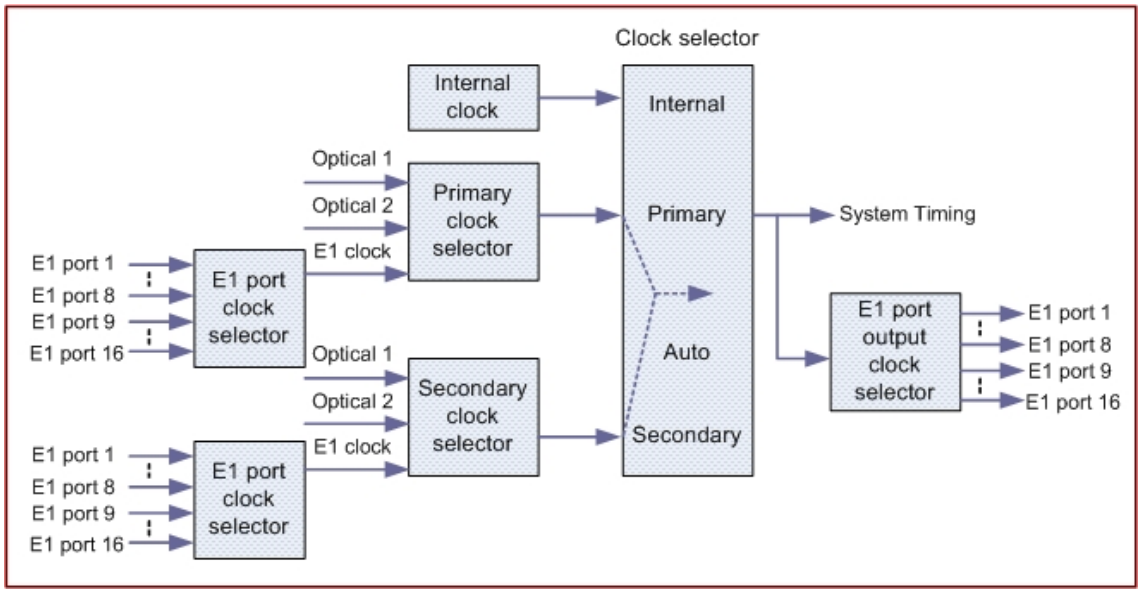


Figure 1-10 SDH Timing Subsystem (with E1 ports), functional diagram

Figure 1-10 shows the functional block diagram of the SDH timing subsystem for MUXpro with E1 ports.

For redundancy, the timing subsystem includes two similar sections, one for selecting the primary SDH clock reference and the other for the secondary clock.

The user can specify the SDH clock reference source from the following options:

- Automatic and revertible clock source switching: The reference source of the recovered clocks can be selected automatically in accordance with the primary or secondary clock of which status is normal. The primary clock source will be selected if both primary and secondary clock statuses are normal. In case of the primary clock source failed, MUXpro automatically switches from the primary clock source to the secondary one. In case of the primary clock source recovered, MUXpro automatically switches back from

the secondary clock source to the primary one. Therefore, different sources must be configured for the primary and secondary clocks.

- Locked to a recovered clock (RX clock option). The reference source of the recovered clocks can be selected in accordance with the desired method of clock dissemination in the user's network:
  - RX SDH – reference source locked to the receive clock recovered from the line signal by the STM-1 interface. This timing mode is also called loopback timing. Either Optical1 or Optical2 can be selected for RX SDH. The SDH timing of the MUXpro units can be locked to the highly accurate master clock of the SDH network.
  - RX E1 – reference clock locked to the receive clock recovered from the E1 line signal received by the desired E1 interface. This timing mode is also called external timing. One of E1 ports can be selected for RX E1. MUXpro820 provides E1 port 1 to E1 port 8. MUXpro8216 provides E1 port 1 to E1 port 16.This timing mode can enable locking the SDH timing of the MUXpro units used in a private network to the timing of the E1 network.
  - Internal clock: The internal oscillator of MUXpro units provides the timing reference(accuracy±4.6ppm) for MUXpro units used in a private network

1.6.7.2 Output clock

Output clock is used as reference source for the far end. One of E1 ports can be selected for Output clock. MUXpro820 provides E1 port 1 to E1 port 8. MUXpro8216 provides E1 port 1 to E1 port 16. All clock options described above may be used as Output clock (2048Kb/sec) to the far end.

1.6.8 Management Subsystem

1.6.8.1 Firmware Updating

The operation of the MUXpro management subsystem and of its other circuits is determined by software stored in flash memory.

The firmware can be updated using TFTP through any of the management access options described above. Using remote downloading enables network operators to distribute software from a central location rapidly and efficiently. However, other

firmware like U-Boot, Linux Kernel, and FPGA must be sent by the factory to execute updating process.

Note:

Before you upgrade RAMdisk, you are suggested to copy your VCDB parameters in advance. Otherwise all the setting will be returned to factory default because after upgrading RAMdisk, the system will restart to confirm its version. VCDB parameters make a lot of difference and lead system cannot save previous parameter setting.

1.6.9 Power Supply Subsystem

MUXpro can be ordered with100 to 240 ±10VAC, 50/60±3 Hz or -36 to -72 VDC power supply. The unit does not provide a power ON/OFF switch; therefore, starts operating as soon as power is connected.

1.6.10 Supervision, Diagnostics and Performance Monitoring

The MUXpro supports comprehensive diagnostics, performance monitoring, and supervision and maintenance capabilities, for easy maintenance and rapid detection and location of faults.

1.6.10.1 Alarm Reporting

MUXpro generates time-stamped alarm messages that cover all the system events. The time stamp is provided by an internal real-time clock. Up to 255 of the most recent alarms can be stored in an internal buffer; in case the MUXpro is powered down, up to 100 of the most recent alarms are stored in non-volatile memory, and remain available for display and analysis after the MUXpro is powered up again.

The alarm messages stored in the buffer can be read on-line by means of the local supervisory terminal, a Telnet host or Web browser, and can also be automatically sent as traps to selected management stations.

1.6.10.2 Performance Monitoring

Performance monitoring capabilities includes collection of statistics for the application layer, as well as for the physical layer for the user and network ports.

1.6.10.3 Diagnostic Test

The maintenance capabilities include the following functions.

- STM-1 network links: local and remote loopback
- Ethernet: local loopback
- E1 tributaries: local and remote loopback
- The duration of the loopback can be limited, by specifying a time-out interval after which the loopback is automatically disconnected.
- Ping for IP connectivity testing.

The loopback enable rapid and efficient isolation of the equipment unit causing the problem, thereby enabling rapid restoration of service. Error free test is less than 1 in 10^{12}bits.

1.6.10.4 Physical Characteristics

The MUXpro is a compact unit (only 1U high). One or two units can be installed side by side in a 19” rack, using appropriate rack-mount kits.

Cooling is by free air convection. In addition, the MUXpro has a miniature internal cooling fan. The air intake vents are located on the side walls, and the exhaust vent is located on the rear panel.

1.7 Technical Specification

Table 1-4 General Features of MUXpro Series Product

LAN Ports	Number of Ports	4
	Compatibility	Relevant Section IEEE802.3u, 802.3x
	Data Rate	• 10BaseT: 10 Mbps • 100Base-Tx: 100 Mbps • Auto-sensing, Auto-negotiation
	Internal LAN Traffic Processing	Ethernet switch with four LAN ports, one port for management subsystem, and four VCG ports (toward the network) connected to virtually concatenated groups 1 to 4. Supports QoS, port-based VLANs and tag-based VLAN switching
	Connectors	RJ-45, shielded
Transparent LAN Ports	Number of Ports	2
	Data Rate	• 10BaseT: 10 Mbps • 100Base-Tx: 100 Mbps • Auto-sensing, Auto-negotiation
	Internal LAN Traffic Processing	Transparent connection to a virtually concatenated group (5 and 6)
	Connectors	RJ-45, shielded
E1 Interfaces	Number of Ports	8 (MUXpro 820) 16 (MUXpro 8216)
	Compatibility	ITU-T Rec. G.703, unframed
	Line Rate	2.048Mbps±50ppm
	Line Coding	HDB3
	Interface Type (By customer's order)	120Ω balanced 75Ω unbalanced
	Connectors	SCSI II, female
STM-1 Optical Network Interface	Number of Ports	2, 1+1 MSP protection available
	Optical line coding	Binary Non-Return-to-Zero
	Framing	SDH, see Appendix H.
	Bit Rate	155.520Mbps
	Optical Wavelength	1310nm

	Optical Output Power	-6dBm
	Receiver Sensitivity	-34dBm
	Connectors	SC or FC/PC
Timing	SDH Timing Source	• Internal clock • RX SDH – Locked to clock recovered from STM-1 interface • RX PDH – Locked to clock recovered from selected PDH interface
	PDH Timing Source	• RX SDH – Locked to clock recovered from STM-1 interface • RX VC-12/RX VC3 – Locked to clock recovered from VC-12 received from remote end
Indicators	General System Indicators	• PWR (green) – Power • TST (yellow) – Test • MAJ ALM – Major alarm • MIN ALM – Minor alarm • ACO – Alarm Cut Off • TRI (For MUXpro 8216) – Tributary
	LAN Port Indicators	• LINK (green) – LAN link integrity • ACT (green) – LAN data activity
	STM-1 Port Indicators	• LOS1 (red) – Loss of Signal Optical 1 • LOS2 (red) – Loss of Signal Optical 2
Power	Supply Voltage AC Source	110 to 240±10VAC 50 to 60±3Hz
	Supply Voltage DC Source	-36 to -72 VDC
Physical	Dimension	MUXpro 820: Half 19”, 1U 210mm(W)*285mm(D)*41mm(H)
		MUXpro 8216: Full 19”, 1U 437mm(W)*287mm(D)*44mm(H)
Operating Environment	Operating temperature	0 to 50°C / 32 to 122°F
	Storage temperature	-25 to 70°C / -13 to 158°F
	Relative humidity	Up to 95%, non-condensing

Chapter 2. Installation

2.1 Introduction

This Chapter provides installation, operational instructions for the MUXpro Series Product and to ensure that the unit is working properly.

2.1.1 Unpacking

Make a preliminary inspection of the shipping container before unpacking, evidence of damage should be noted and reported immediately to the nearest Tainet representative.

Unpack the equipment as follows:

- Place the container with the top facing upwards.
- Unpack equipment carefully, check for completeness against the purchase order.
- Inspect equipment for shipping damage, including bent or loose hardware, or broken connectors.
- To prevent electrostatic discharge (ESD) damage, avoid touching the internal components. Before plugging in any user interface module, please turn the power off.

MUXpro's shipping package should include the following items:

- A MUXpro stand alone unit
- User Manual in CD type
- A power adapter and/or a power cord
- DB-9 Cable
- Kits for rack installation (MUXpro 820 is by order; MUXpro 8216 is included)

2.1.2 Safety Precautions

2.1.2.1 General Safety Precautions

Caution:

Either the operator or the user may perform no internal settings, adjustment, maintenance, and repairs; only skilled service personnel who are aware of the hazards involved may perform such activities. Always observe standard safety precautions during installation, operation, and maintenance of this product.

Warning:

For your protection and to prevent possible damage to equipment when a fault condition, e.g., a lightning stroke or contact with high-voltage power lines, occurs on the cables connected to the equipment, the case of the MUXpro. Unit must be properly grounded at any time. Any interruption of the protective (grounding) connection inside or outside the equipment, or the disconnection of the protective ground terminal can make this equipment dangerous.
Intentional interruption is prohibited.

Caution:

Dangerous voltages may be present on the cables connected to the MUXpro.

- Never connect cables to a MUXpro unit if it is not properly installed and grounded.
- Disconnect all the connected cables to the electrical connectors of the MUXpro before disconnecting the MUXpro power cable.

Before switching on this equipment and before connecting any other cable, the protective ground terminal of MUXpro must be connected to a protective ground.

The grounding connection is made through the power cable, which must be inserted in a power socket (outlet) with protective ground contact. Therefore, the power cable plug must always be inserted in a socket outlet provided with a protective ground contact, and the protective action must not be negated by use of an extension cord (power cable) without a protective conductor (grounding).

Whenever MUXpro units are installed in a rack, make sure that the rack is properly grounded and connected to a reliable, low-resistance grounding system. Make sure that fuses of the required rating are used for replacement. The use of repaired fuses and the short-circuiting of fuse holders are forbidden.

Whenever it is likely that the protection offered by fuses has been impaired, the instrument must be made inoperative and be secured against any unplanned operation.

2.1.2.1.1 Laser Safety Classification

MUXpro units equipped with laser devices comply with laser product performance standards set by government agencies for Class 1 laser products. The modules do not emit hazardous light, and the beam is totally enclosed during all in-service modes of customer operation and maintenance.

MUXpro units are shipped with protective covers installed on all the optical connectors. Do not remove these covers until you are ready to connect optical cables to the connectors. Keep the covers for reuse, to reinstall the cover over the optical connector as soon as the optical cable is disconnected.

2.1.2.1.2 Laser Safety Statutory Warning and Operating Precautions

All the personnel involved in equipment installation, operation, and maintenance must be aware that the laser radiation is invisible. Therefore, the personnel must strictly observe the applicable safety precautions and particularly must avoid looking straight into optical connectors, neither directly nor using optical instruments.

In addition to the general precautions described in this section, be sure to observe the following warnings when operating a product equipped with a laser device.

Failure to observe these warnings could result in fire, bodily injury, and damage to the equipment.

Warning:

To reduce the risk of exposure to hazardous radiation:
Do not try to open the enclosure. There are no user-serviceable components inside.
Do not operate controls, make adjustments, or perform procedures to the laser device other than those specified herein.
Allow only authorized Tainet service technicians to repair the unit herein.
Allow only authorized Tainet service technicians to repair the unit.

2.1.2.2 Protection against Electrostatic Discharge (ESD)

An electrostatic discharge occurs between two objects when an object carrying static electrical charges touches, or is brought near enough, the other object.

Static electrical charges appear as a result of friction between surfaces of insulating materials, separation of two such surfaces and may also be induced by electrical fields.

Routine activities such as walking across an insulating floor, friction between garment parts, friction between objects, etc. can easily build charges up to levels that cause damage, especially when humidity is low.

Caution:

MUXpro internal boards contain components sensitive to ESD. To prevent ESD damage, do not touch internal components or connectors.
If you are not using a wrist strap, before touching a MUXpro unit or performing any internal settings on the MUXpro, it is recommended to discharge the electrostatic charge of your body by touching the frame of a grounded equipment unit.

Whenever feasible, during installation works use standard ESD protection wrist straps to discharge electrostatic charges. It is also recommended to use garments

and packaging made of antistatic materials or materials that have high resisting, yet are not insulators.

2.1.3 Site Selection and Requirements

2.1.3.1 Physical Requirements

The MUXpro can be installed in racks, on desktop and shelves. All the connections, except for the STM-1 interface connection, are made to the rear panel.

For installation in 19” racks, Tainet offers dedicated rack mount kits that enable installing one or two MUXpro units side-by-side. Two MUXpro units installed with the rack mount kit occupy a height of 1U.

2.1.3.2 Power Requirements

AC-powered MUXpro units should be installed within 1.5m (5 feet) of an easily-accessible grounded AC outlet that is capable of furnishing the required AC supply voltage, in the range of 100 to 240±10 VAC, 50 to 60±3 Hz.

DC-powered MUXpro units require a -36 to -72 VDC power source with positive terminal grounded. In addition, the DC power connector contains the chassis (frame) ground terminal.

2.1.3.3 Network and User Connections

This section presents general requirements regarding the connections to the various MUXpro interfaces. For specific information regarding pin allocations in the MUXpro connectors, refer to Appendix A .

2.1.3.3.1 Network Connection

Optical Ports. MUXpro units can be ordered with two STM-1optical ports.

Each port has two optical connectors, one is for the receive input and the other is for the transmit output. The MUXpro can be ordered with FC/PC or SC connectors, for use over single-mode or multimode fibers.

2.1.3.3.2 E1 Port Connections

Each MUXpro E1 port can be configured to use either one of the following interfaces

- 120 Ω balanced interface for operation over an SCSI II, female connector.
- 75 Ω unbalanced interface for operation over coaxial cable.

2.1.3.3.3 LAN Port Connections

The MUXpro have six LAN ports.

Each LAN port has a 10/100BaseTX Ethernet interface terminated in an RJ-45 connector, designated LAN 1 to LAN 6, respectively, for connection to LANs operating on UTP media.

The interface connector is wired as a hub port that includes automatic crossover detection and correction. Therefore, it can always be connected through a “straight” (point-to-point) cable to any other 10/100BaseTX port (hub or station).

2.1.3.3.4 Supervisory Terminal Port Connections

The out-of-band supervisory port of the MUXpro, designated CRAFT, has a serial RS-232 asynchronous DCE interface terminated in a 9-pin D-type female connector, designated CRAFT. The port can be directly connected to terminals that use a wired point-to-point cable.

2.1.3.3.5 Alarm Relays Connections

The alarm interface is included in the ALARM connector (see Appendix A).

The interface includes four relays, two for the major alarms including office audio and visible alarm system and the other two for the minor alarms including office audio and visible alarm system as well.

2.1.3.3.6 Ambient Requirements

The ambient operating temperature of the MUXpro is 0 to 50°C (32 °F to 122 °F), at a relative humidity of up to 95%, non-condensing.

The MUXpro is cooled by free air convection, and also has a miniature internal cooling fan. When the MUXpro is installed in a 19" rack, allow at least 1U of space below and above the unit.

2.1.3.3.7 Electromagnetic Compatibility Considerations

The MUXpro is designed to comply with the electromagnetic compatibility (EMC) requirements of Sub-Part J of FCC Rules, Part 15, for Class A electronic equipment, and additional applicable standards. To meet these standards, it is necessary to perform the following actions:

- Connect the MUXpro to a low-resistance grounding system.
- Whenever feasible, use shielded cables.

2.1.4 Equipment Needed

The cables you need to connect to the MUXpro depend on the MUXpro application. You can use standard cables or prepare the suitable cables yourself in accordance with the information given in Appendix A .

Contact Tainet Technical Support Department if other interface cables are necessary.

2.1.5 MUXpro Enclosure

This section presents a physical description of the MUXpro versions.

2.1.5.1 MUXpro 820 Front Panel Description

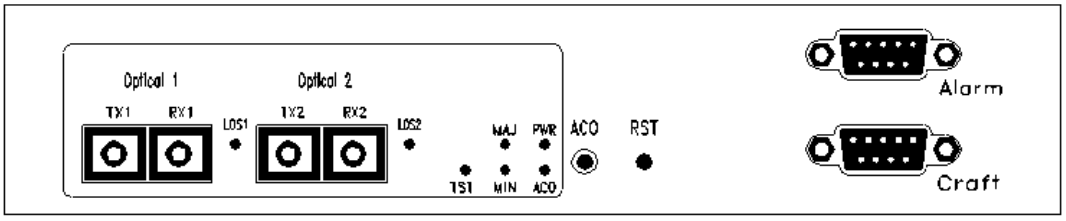


Figure 2-1 MUXpro 820 front panel

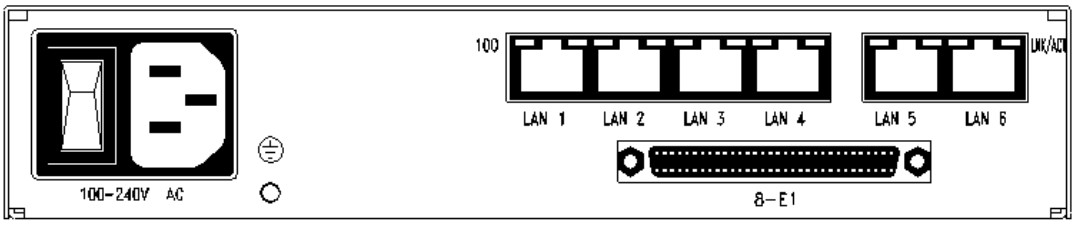


Figure 2-2 MUXpro 820 rear panel (AC)

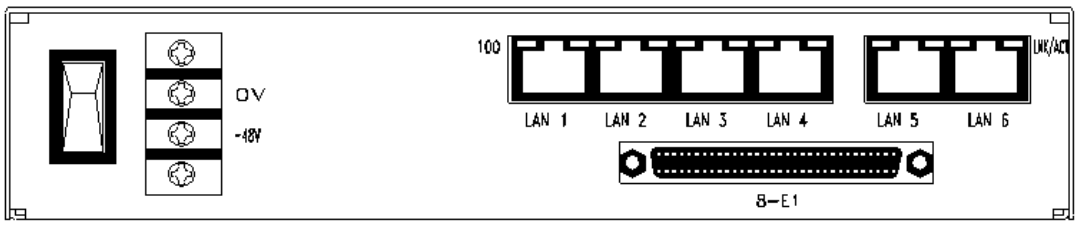


Figure 2-3 MUXpro 820 rear panel (DC)

The components located on the front panel are arranged in several functional groups:

- System status indicators: The groups of indicators located in the lower middle side of the panel display the system status.

Table 2-1 Front Panel Description of MUXpro 820

LED Indicator / Buttons	Status	Description
LOS	Red	Alarm in SDH channel 1/channel 2
	Off	SDH L1/L2 is in normal condition
PWR	Green	Power ON
	Off	Power OFF
MAJOR	Red	Major alarm occurred in the system
	Off	No major alarm
MINOR	Yellow	Minor alarm occurred in the system
	Off	No minor alarm
TST	Yellow	For test purpose, when loopback function is enabled, LED will turn to yellow
	Off	Loopback function disabled
ACO	Yellow	After pressing ACO button, LED will turn to yellow instead
RST	Press	Reset the hardware by pressing this button
ACO	Press	Alarm Cut Off button, press to clear the alarm

- The aggregated interfaces area: The aggregated interfaces (at the left side) include optical interfaces.

The optical interfaces include two pairs of optical connectors, identified as Optical 1 and Optical 2. Each pair consists of a transmit (TX) connector and a receive (RX) connector. Link status indicators are located to the right of each pair of connectors.

- Auxiliary connector area: includes the ALARM and CRAFT connectors.

□ ALM:

The ALARM relay contact is to extend the major and minor alarm of MUXpro 820 to the office audible and visual alarm system. Refer to Appendix A for its pin assignment.

□ CRAFT:

The Front panel CRAFT port serves as a normal supervise port and operates at standard RS-232 DCE mode in DB-9 type connector, it can direct connect to PC COM port for operation.

The components located on the rear panel are arranged in several functional groups:

- Power supply: The rear panels include only the AC or DC power connector (in accordance with order), for connection of the MUXpro 820 supply voltage and protective ground. The AC connector has a built-in fuse.
- LAN ports: The LAN ports include six Ethernet interfaces (4 VLAN ports, 2 transparent ports) terminated in LAN 1, LAN 2, LAN 3, LAN 4, LAN 5 and LAN 6. Each connector has a pair of built-in indicators.
- E1 interface: 8 E1 ports for SCSI II female connector. Hot Swappable is not supported.

2.1.5.2 MUXpro 8216

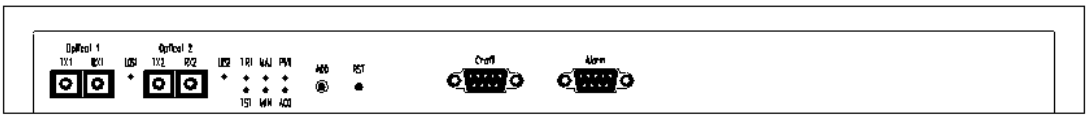


Figure 2-4 MUXpro 8216 front panel

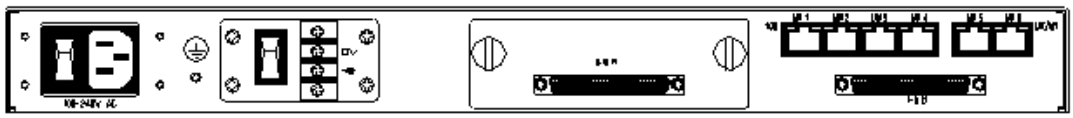


Figure 2-5 MUXpro 8216 rear panel (AC+DC)

The components located on the front panel are arranged in several functional groups:

- System status indicators: The groups of indicators located in the lower middle side of the panel display the system status.

- The aggregated interfaces area: The aggregated interfaces (at the left side) include optical interfaces.
- The optical interfaces include two pairs of optical connectors, identified as Optical 1 and Optical 2. Each pair consists of a transmit (TX) connector and a receive (RX) connector. Link status indicators are located to the right of each pair of connectors.
- Auxiliary connector area: includes the ALARM and CRAFT connectors.

  □ ALM:

  The ALARM relay contact is to extend the major and minor alarm of MUXpro 820 to the office audible and visual alarm system. Refer to Appendix A for its pin assignment.

  □ CRAFT:

  The Front panel CRAFT port serves as a normal supervise port and operates at standard RS-232 DCE mode in DB-9 type connector, it can directly connect to PC COM port for operation.

Table 2-2 Front Panel Description of MUXpro 8216

LED Indicator / Buttons	Status	Description
LOS	Red	Alarm in SDH channel 1/channel 2
	Off	SDH L1/L2 is in normal condition
PWR	Green	Power ON
	Off	Power OFF
MAJOR	Red	Major alarm occurred in the system
	Off	No major alarm
MINOR	Yellow	Minor alarm occurred in the system
	Off	No minor alarm
TST	Yellow	For test purpose, when loopback function is enabled, LED will turn to yellow
	Off	Loopback function disabled
ACO	Yellow	After pressing ACO button, LED will turn to yellow instead
	Off	Alarm disappears, back to normal condition
TRI	Yellow	Abnormal tributary E1 card
	Off	Normal tributary E1 card

LED Indicator / Buttons	Status	Description
RST	Press	Reset the hardware by pressing this button
ACO	Press	Alarm Cut Off button, press to clear the alarm

The components located on the rear panel are arranged in several functional groups:

- Power supply: The rear panel includes only the AC or the DC power connector (in accordance with order), for connection of the MUXpro 820 supply voltage and protective ground. The AC connector has a built-in fuse.
- LAN port: There are six Ethernet interfaces (4 VLAN ports, 2 transparent ports) terminated in LAN 1, LAN 2, LAN 3, LAN 4, LAN 5 and LAN 6. Each connector has a pair of built-in indicators.
- E1 interface: 16 E1 ports for SCSI II female connector, 8 for built-in E1 and the other 8 E1 ports are tributary. Tributary E1 card is hot swappable.

2.1.6 Connections

Caution:

Before installing a MUXpro unit, review the safety precautions given in Section 2.1.2

2.1.6.1 Installing a MUXpro Unit

MUXpro units are intended for installation on desktops, shelves or in 19” racks.

For rack installation, a rack mount kit is available from Tainet. Refer to the installation leaflet of the rack mount kit for detailed instructions.

Do not connect power to the enclosure before it is installed in the designated position.

2.1.6.2 Cable Connection, General

Before starting, refer to the site installation plan and identify the cables intended for connection to the MUXpro unit.

For general information regarding the required connections, refer to Section 2.1.3.

- General Optical Cable Handling Instructions

When connecting optical cables make sure to prevent cable twisting and avoid sharp bends (unless otherwise specified by the optical cable manufacturer, the minimum fiber bending radius is 35 mm). Always leave some slacks, to prevent stress.

Caution:

Make sure all the optical connectors are closed at all times by the appropriate protective caps, or by the mating cable connector.
Do not remove the protective cap until an optical fiber is connected to the corresponding connector, and immediately install a protective cap after a cable is disconnected.

Before installing optical cables, it is recommended to clean thoroughly their connectors using an approved cleaning kit.

2.1.6.3 Connecting MUXpro to Ground and Power

Any interruption of the protective (grounding) conductor (inside or outside the device) or disconnecting the protective earth terminal can make the device dangerous. Intentional interruption is prohibited.

Caution:

Before switching this MUXpro unit on and before connecting any other cable, MUXpro protective ground terminals must be connected to protective ground.
This connection is made through the DC or AC power cable.
The power cord plug should only be inserted in an outlet provided with a protective ground (earth) contact. The protective action must not be negated by using an extension cord (power cable) without a protective conductor (grounding).

Warning:

Dangerous voltages may be present on the cables connected to the MUXpro:

- Never connect cables to a MUXpro unit if it is not properly installed and grounded. This means that its power cable must be inserted in an outlet provided with a protective ground (earth) contact before connecting any user or network (network) cable to the MUXpro.
- Disconnect all the cables connected to the connectors of the MUXpro before disconnecting the MUXpro power cable.

Power should be supplied to MUXpro through a power cable terminated in an appropriate plug, in accordance with the required power source.

■ To connect MUXpro power and ground

- □ Connect one end of the power cable to the MUXpro power connector.
- □ When ready to apply power, insert the plug at other end of the power cable into a socket (outlet) with a protective ground contact. The PWR indicator of the MUXpro must light.

2.1.6.4 Connecting MUXpro Links to Network Ports

The network connections are made in accordance with the interface type ordered for your MUXpro:

- Optical Cable Connection Instructions

Optical interfaces: connect to the optical connectors in the Optical 1 and Optical 2 areas.

- To connect optical cables to the MUXpro network interface:
  - For each optical interface (Optical 1 or Optical 2), refer to the site installation plan and identify the corresponding pair of cables intended for connection to the corresponding TX and RX connectors.
  - Connect the prescribed transmit fiber (connected to the receive input of the remote equipment) to the TX connector. Leave enough slack to prevent strain.
  - Connect the prescribed receive fiber (connected to the transmit output of the remote equipment) to the RX connector of the same interface. Leave enough slack to prevent strain.

2.1.6.5 Connecting MUXpro to E1 Ports

- To connect cables to the MUXpro E1 ports

The connection to the MUXpro E1 ports is made to be suitable for the SCSI II; female connectors designated E1. Different model of MUXpro Series has different amount of E1 ports. For MUXpro 820, there are 8 built-in E1 ports. For MUXpro 8216, there are 16 E1 ports, 8 for built-in and others are tributary.

Figure 2-6 BNC connectors for 16 ports unbalanced E1 panel

Figure 2-7 Wire-wrap connectors for 16 ports balanced E1 panel

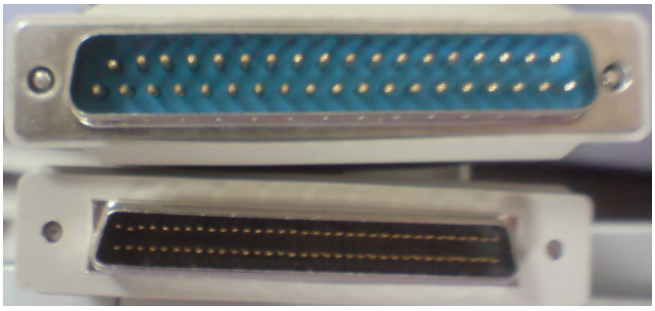


Figure 2-8 Converter cable

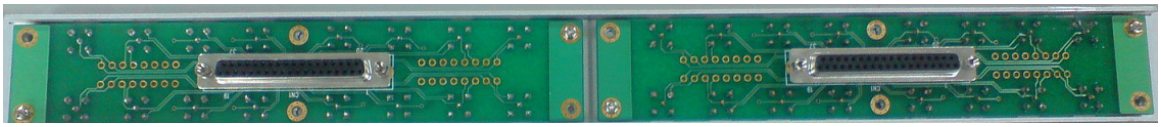


Figure 2-9 On the back of the unbalanced E1 panel

2.1.6.6 Connecting MUXpro to LAN Ports

- To connect cables to the MUXpro LAN ports

The connection to the MUXpro LAN ports is made to the RJ-45 connectors designated LAN. Use a standard (station) cable wired point-to-point for connection to any type of Ethernet port (hub or station).

2.1.6.7 Management Connections

- To connect cables to the MUXpro supervisory ports

The connections to the CRAFT connector are made as follows:

- Connection to a supervision terminal with 9-pin connector: by means of a straight cable (a cable wired point-to-point).
- Connection to modem with 9-pin connector (for communication with remote supervision terminal): by means of a crossed cable.

Additional connection options are presented in Appendix A .

- To connect to a management station, Telnet host or Web browser

The link to network management stations using SNMP, to Telnet hosts and/or Web browsers can be provided in two ways:

- In-band, it can be linked through the network. This connection is automatically available when the network cables are connected, provided

IP connectivity to the management station; Telnet host or Web browser is available through the network port.

- Through the LAN 1 to LAN 4 connector, provided IP connectivity to the management station or Telnet host is available through the LAN the port is connected to (for example, when the management station, Telnet host or Web browsers is attached to the same LAN, or connected to the same WAN).

2.1.6.8 Connecting to MUXpro ALARM Connector

- To connect to MUXpro ALARM connector

The connection to the ALARM connector is made by means of a cable provided by the customer, in accordance with the specific requirements of each site. Refer to Appendix A for connector pin functions.

Chapter 3. Configuration

3.1 Scope

This chapter provides general operating instructions and preliminary configuration instructions of WEB UI for MUXpro units.

3.2 Operating Instructions

3.2.1 Connect to Web UI via LAN Port

The factory default IP of MUXpro series is 192.168.0.1 with mask 255.255.0.0. User can configure MUXpro with web interface via RJ-45 connector.

There are two Admin users with user ID admin and tainet. Default ID and Password Table is shown below:

Table 3-1 Default ID and Password for MUXpro product family

	Login ID	Login Password
MUXpro 820	admin	admin
	tainet	tainet
MUXpro 8216	admin	admin
	tainet	tainet

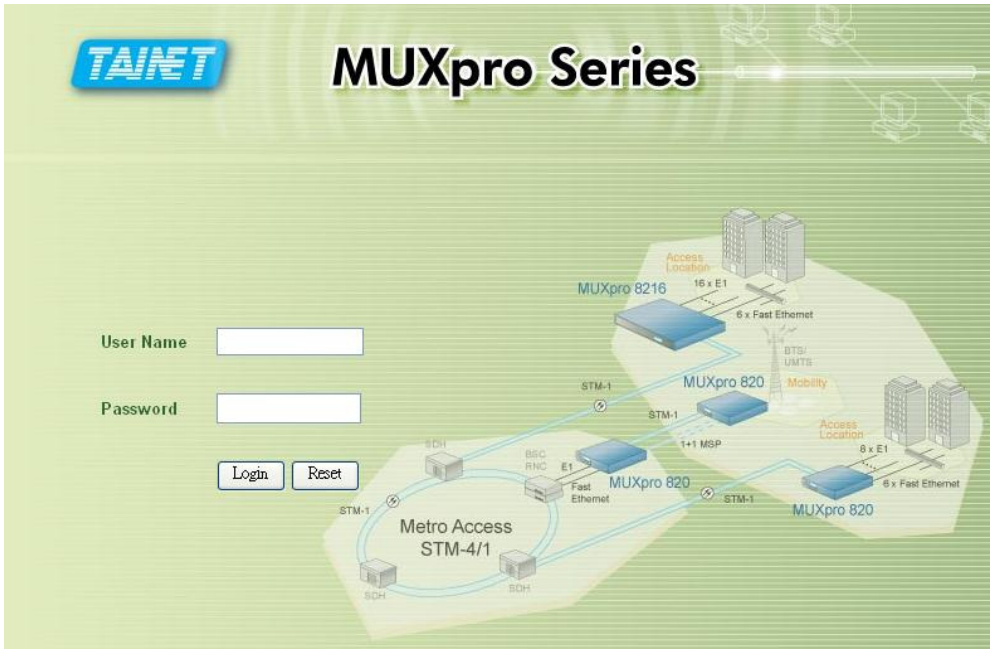


Figure 3-1 MUXpro Series Web Interface Login Page

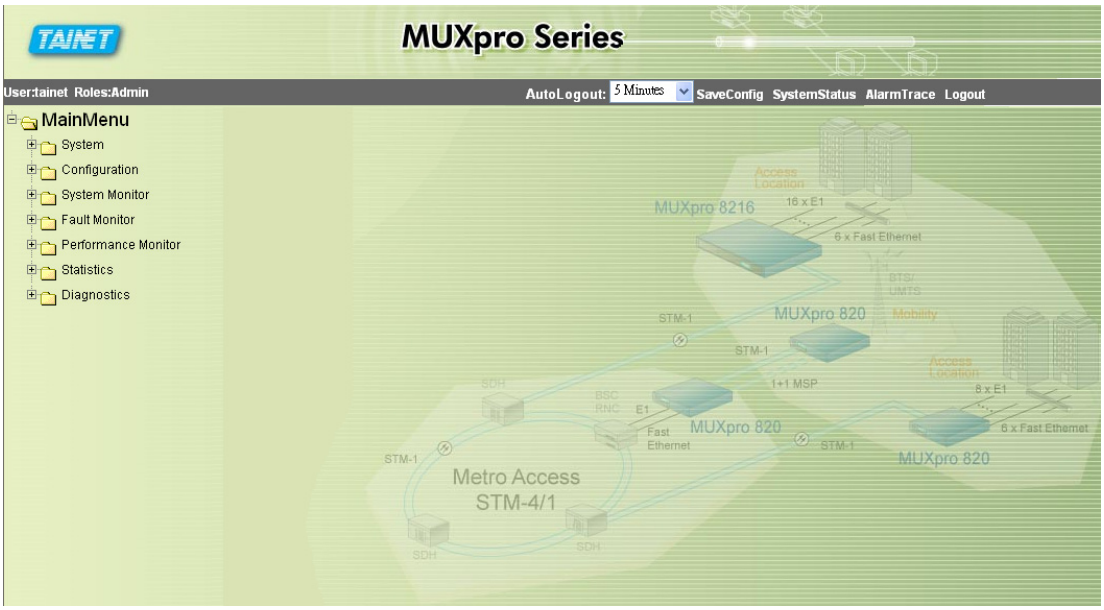


Figure 3-2 Main Menu

3.3 First Login

We suggest user change the default password, referring to the step below.

- System → User Management： [Change password]

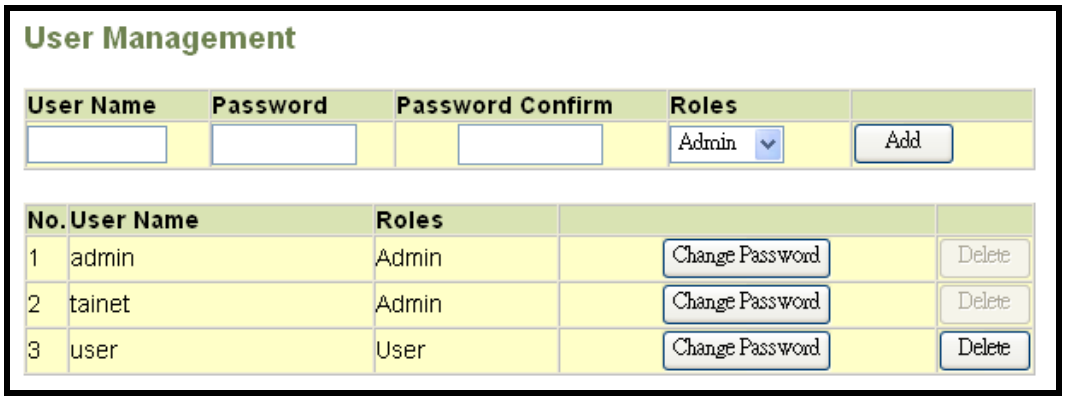


Figure 3-3 User Management

Caution:

There are two Admin users with user name admin and tainet. These two default Admin users cannot be deleted and we suggest changing the default password for security reasons. If the password of any Admin user is lost, press and hold the ACO button in the front panel for over 10 seconds and release the ACO button. Finally, press RST button and the password of two Admin users will be restored to default values after rebooting.

3.4 Starting Configuration

There are seven main function groups in the Web UI. The description is as below.

Table 3-2 Main function groups description

Main Function Groups	Description
System	The basic configuration of the system, including time and date, device Info, and user management etc.
Configuration	The main function of the MUXpro. The function includes the most settings of connectivity, Cross Connect and VLAN function etc.

System Monitor	User can check the parameters of connection, including VCG status, Transmitted Trace ID and Expected Trace ID of Section, VC-4 or VC12.
Fault Monitor	User can check the current alarm event history and alarm log.
Performance Monitor	User can check the parameters of PM, such as CV, ES, SES, and UAS.
Statistics	User can check the statistics of LAN traffic or VCG traffic.
Diagnostics	For diagnostics, user can use this function to Loopback and verify the connection.

3.5 The Basic Concept in Configuring MUXpro

After entering the access level, user may follow the instructions below to become familiar with MUXpro Series Product and be able to configure the units; therefore, the units can work properly. This section will explain the basic concepts during configuring MUXpro product.

3.5.1 System Clock

Define whether the system clock to be Internal or externally received from the selected ports. Here you can also select the Primary and Secondary clock as the system clock from the indicated port or optical line. If the port or line providing the Primary clock fails, the alternative port for Secondary clock will become active as a backup clock. For more information, please refer to 3.7.12

3.5.2 Cross Connection

Establish the internal communication link between SDH and either E1 or VCG. This allows user to do the assignment for the indicated time slots. There are two kinds of cross connection commands, e1xcset and vcgxcset. E1xcset is the E1 port (channel) assigned command, and is used to do the cross connection of E1 ports. Vcgxcset command is a usage for cross a connection to SDH (channel), vcgxcm is used to execute multiple time slots cross connections. For more information, please refer to 3.7.10

3.5.3 Diagnostic

MUXpro Series Product provides the diagnostic ability such as the function of alarm status, performance monitoring and loopback testing. The alarm status shows the current alarm condition in the alarm buffer, and the performance monitoring lists the performance evaluation as a group report for 15-minutes / 1-day interval. The loopback testing may force the data to loop back and check the connection section by section. For more information, please refer to 4.6

3.6 "System" Main function Group Description

This section introduces the sub-functions of "System" Main function group. The "System" main function group includes [Device Info], [General Setup], [Manager List], [SNMP Setup], [DCC Setup], [Alarm Suppression], [User Management], [Config & SW Update], [Craft Port], and [Device Maintenances] functions.

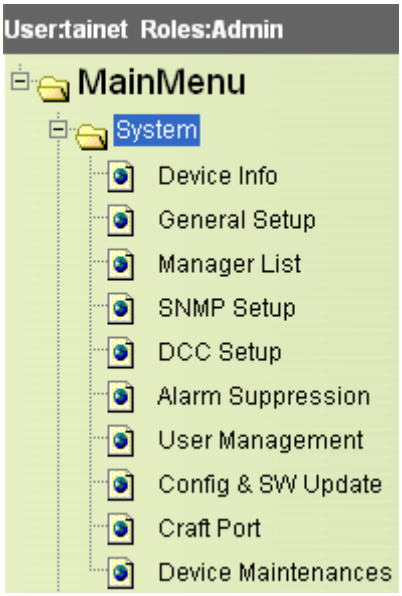
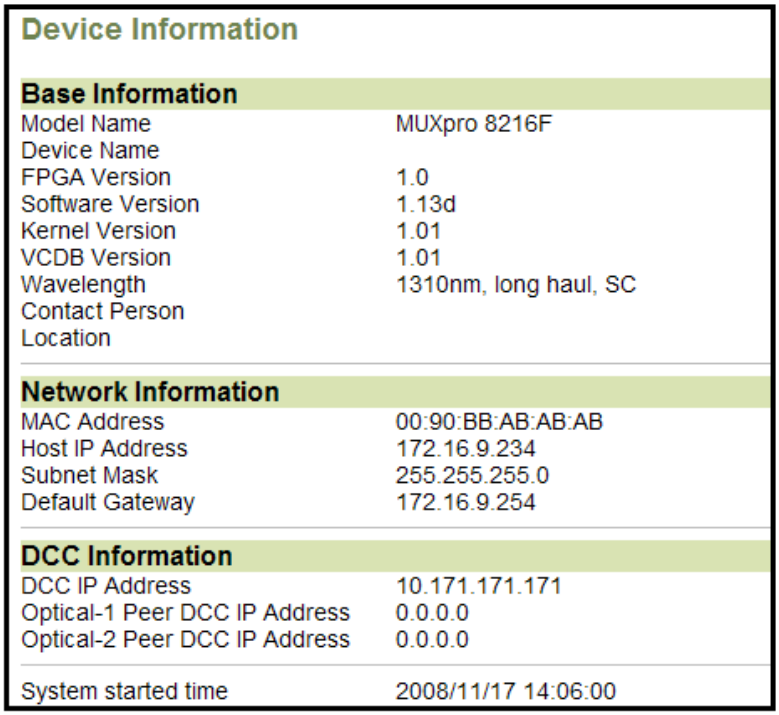


Figure 3-4 The Sub-functions of System Main Function Group

3.6.1 Device Info

User can check the system information and IP settings from this page.



Device Information

Base Information	
Model Name	MUXpro 8216F
Device Name	
FPGA Version	1.0
Software Version	1.13d
Kernel Version	1.01
VCDB Version	1.01
Wavelength	1310nm, long haul, SC
Contact Person	
Location	
Network Information	
MAC Address	00:90:BB:AB:AB:AB
Host IP Address	172.16.9.234
Subnet Mask	255.255.255.0
Default Gateway	172.16.9.254
DCC Information	
DCC IP Address	10.171.171.171
Optical-1 Peer DCC IP Address	0.0.0.0
Optical-2 Peer DCC IP Address	0.0.0.0
System started time	2008/11/17 14:06:00

Figure 3-5 Device Info

3.6.2 General Setup

In this web page, user can set System Information, Date／Time setting and IP settings under the pull down menu of [Category].

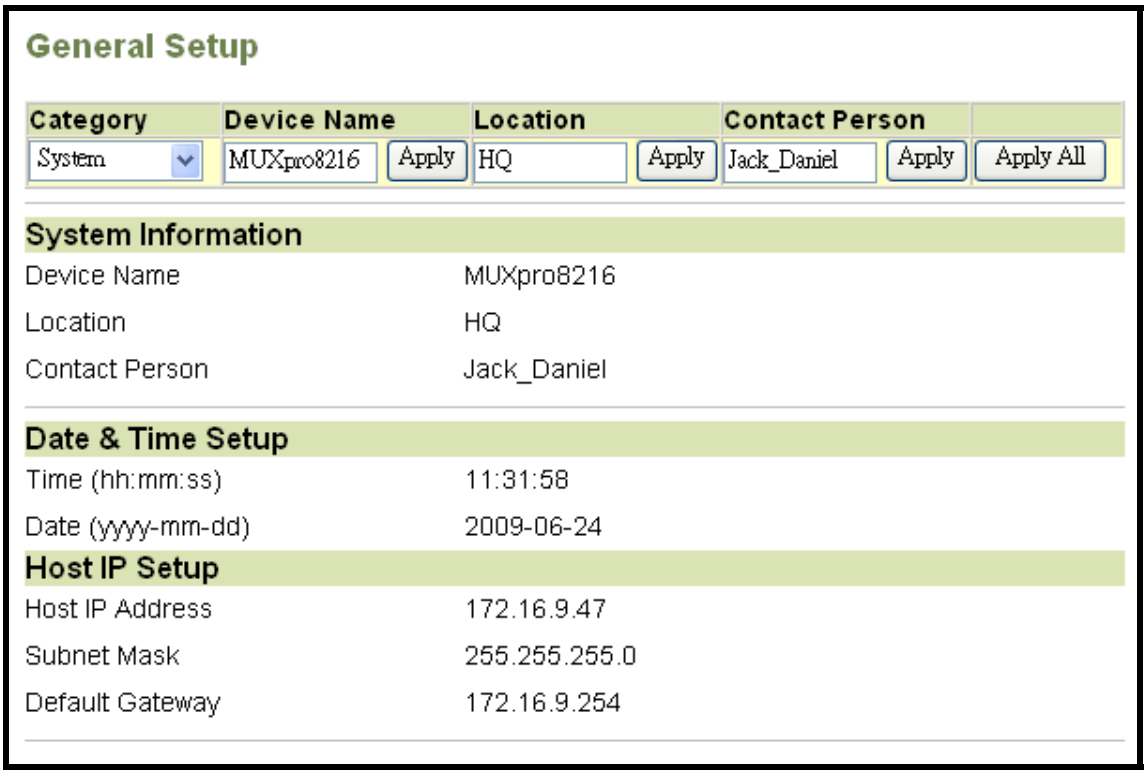


Figure 3-6 General Setup

3.6.3 Manager List

This function allows user to set the IP of PC which the UNMS Client software is installed so the MUXpro units can be monitored and controlled remotely.On the other hand, the SNMP Mode in SNMP Setup function should be enabled before the MUXpro unit can be managed by the UNMS Client. Refer to 3.6.4 for the details of SNMP Setup function.

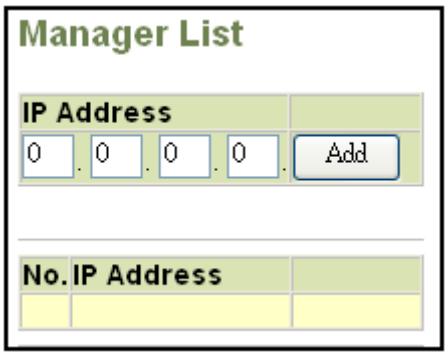


Figure 3-7 Manager List

3.6.4 SNMP Setup

The SNMP Mode can be set to Enable so the MUXpro unit can be managed by universal network management system (UNMS). If it is set to Disable, then the UNMS will not see the MUXpro unit in the network.

This function allows user to set the “read community string” and “write read community string” of SNMP. When system alarm occurs, user can set trap IP where system alarm message will send to.

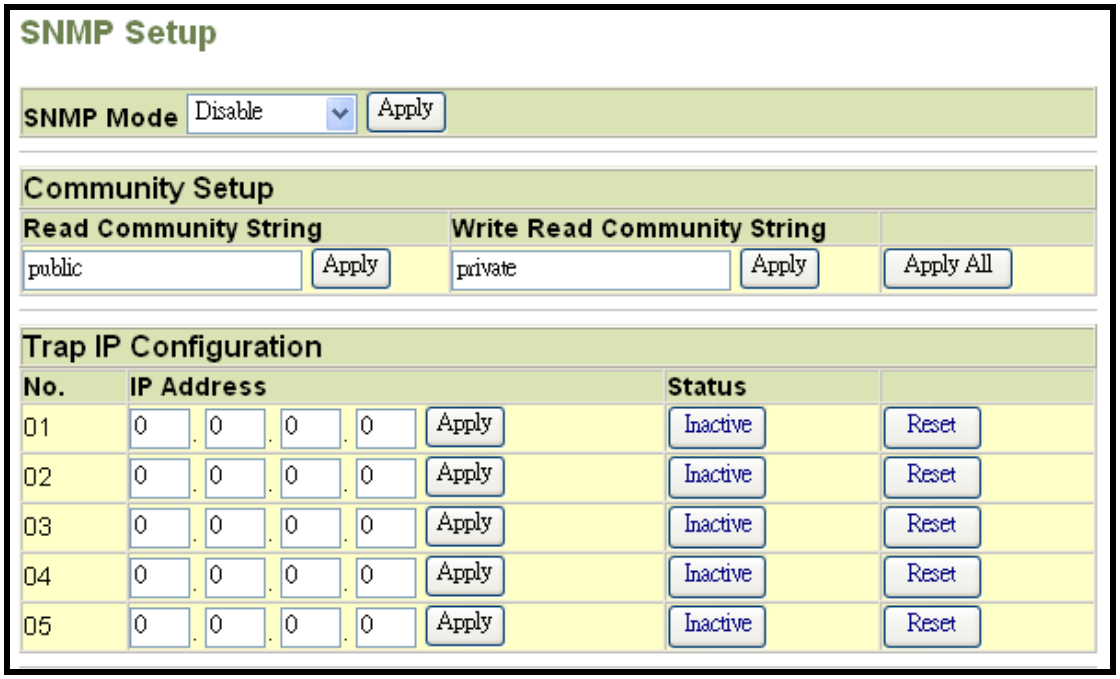


Figure 3-8 Manager List

3.6.5 DCC Setup

In this web page, user can set DCC（Data Communication Channels） IP and channels of section.

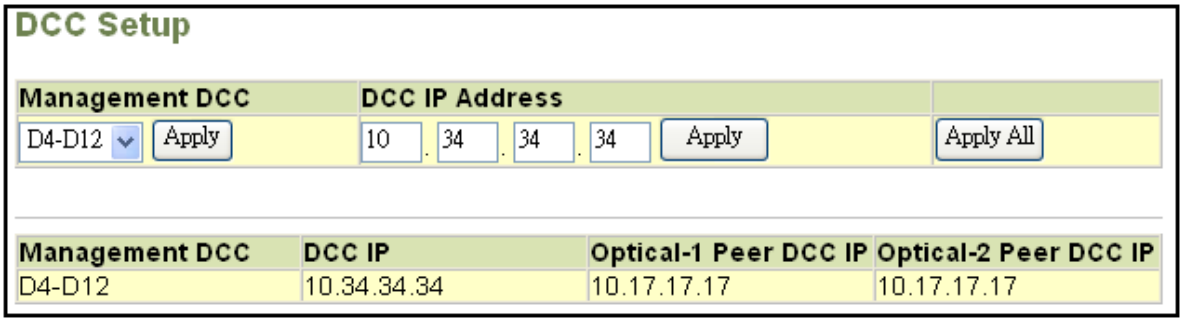


Figure 3-9 DCC Setup

3.6.6 Alarm Suppression

In this web page, user can set whether the alarm messages display in WEB UI （The path：Fault Monitor → System Alarm. For more information, please refer to Section 4.3）

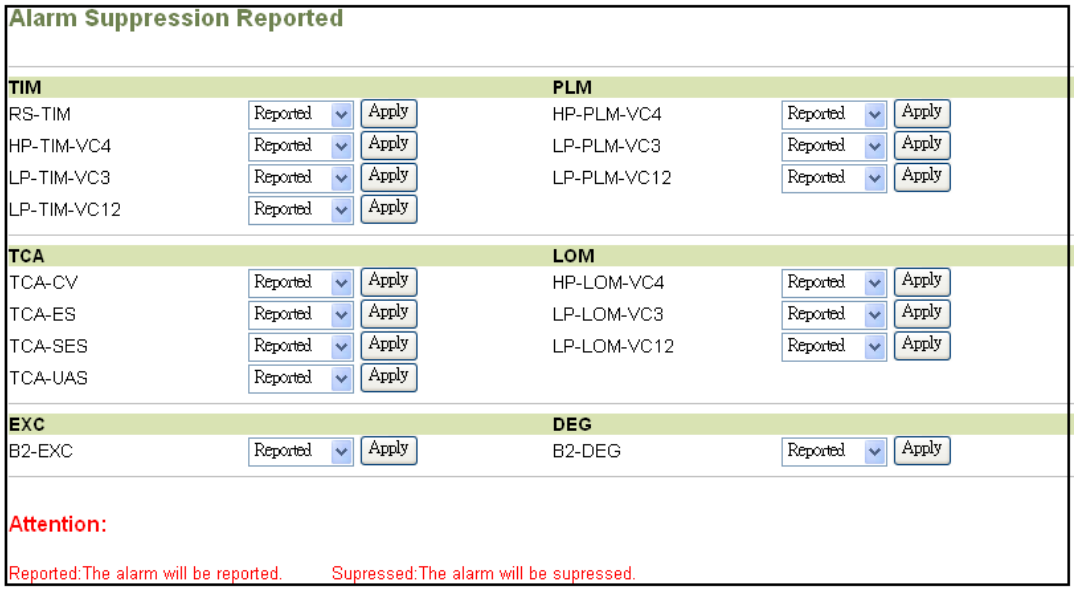


Figure 3-10 Alarm Suppression

3.6.7 User Management

In this page, user can add and delete user account. User can modify the password of accounts (except current user). On the other hand, two default Admin users with user name admin and tainet cannot be deleted, but the password can be changed.

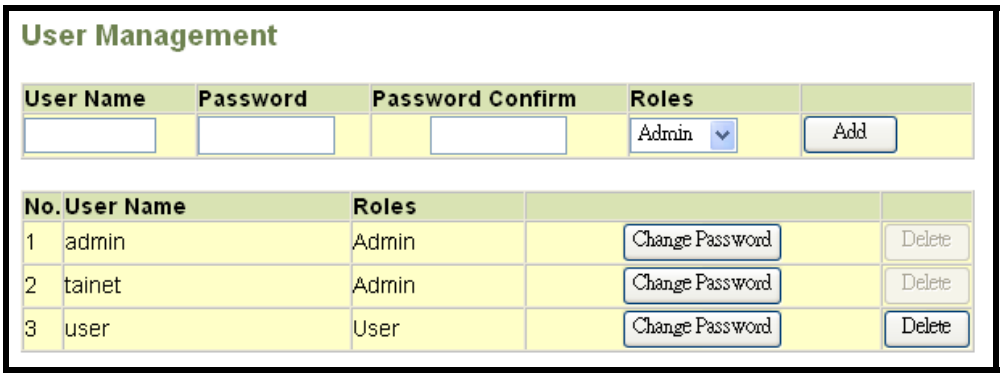


Figure 3-11 User Management

3.6.8 Config & SW Update

This web page allows user to upload / download configuration file and perform upgrade by downloading software via TFTP.

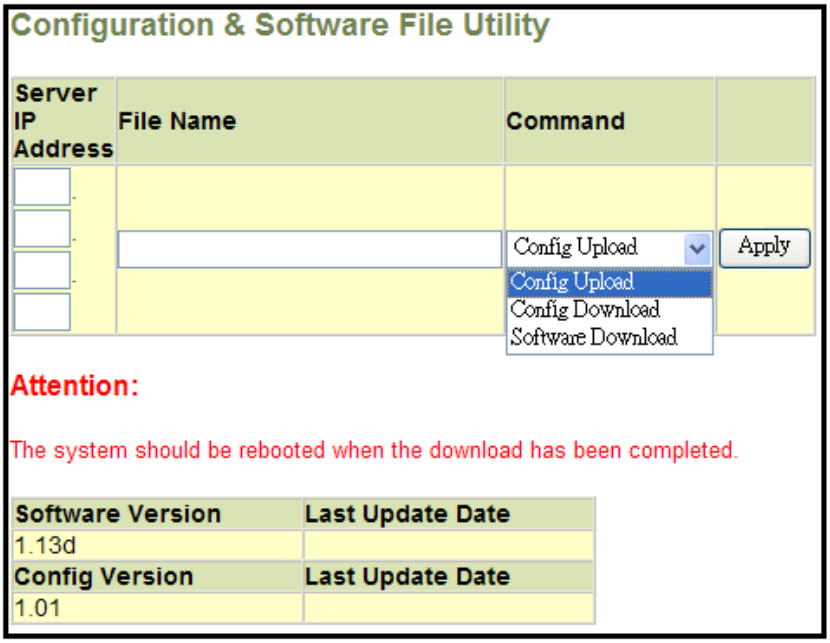


Figure 3-12 Config & SW Update

3.6.9 Craft Port

This web page allows user to change the baud rate of craft port connection. The default baud rate is 38400bps.

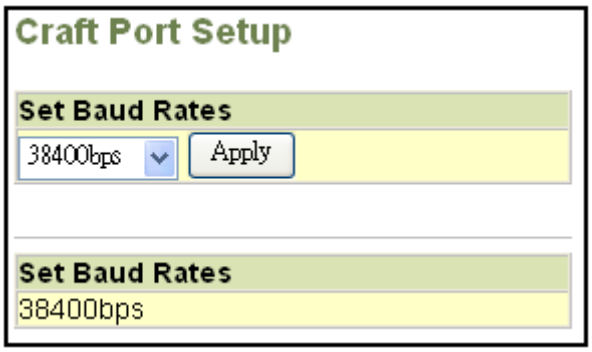


Figure 3-13 Craft Port Setup

3.6.10 Device Maintenances

This web page allows user to reboot the device or restore to default settings.

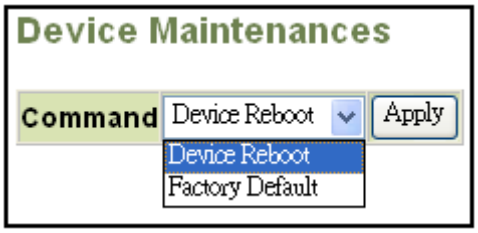


Figure 3-14 Device Maintenance

3.7 "Configuration" Main function Group Description

This section introduces the sub-functions of "Configuration" Main function. The "Configuration" main function includes "Section", "VC-4", "Threshold", "E1 Interface", "LAN Port", "VCG Group", "GFP Group", "GFP Multiplexer", "LAPS Group", "Cross Connect", "Protection", and "Synchronization" functions and one submenu "Bridge".

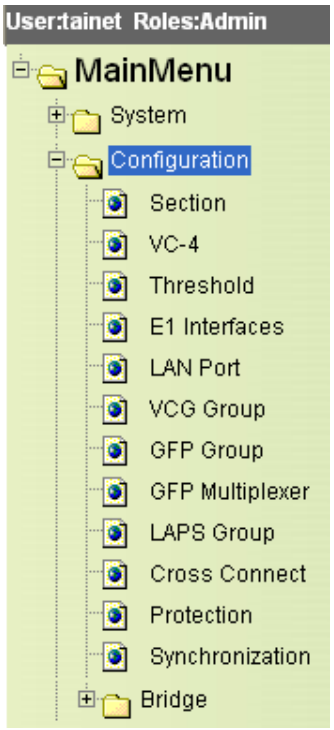


Figure 3-15 The Sub-functions of Configuration Main Function Group

3.7.1 Section

This web page allows user to set parameters of Section.

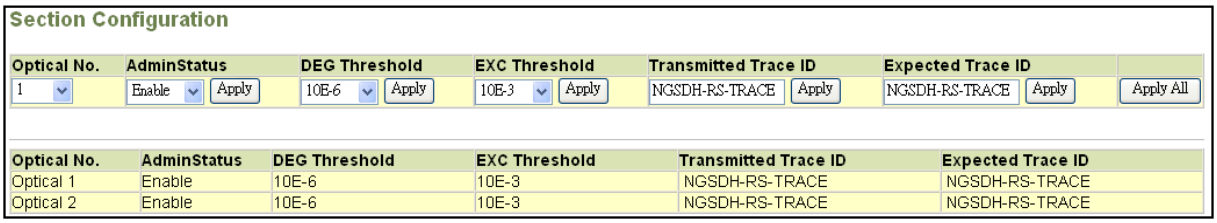


Figure 3-16 Section

Table 3-3 Description of Section function

Pull down menu	Description
Optical No.	User can choose which optical port that will be modified.
AdminStatus	Enable or Disable the specified optical port.
DEG Threshold	Select the BER value; the signal-degraded alarm will be generated for the port if the value is exceeded.
EXC Threshold	Select the BER value; the error rate degradation alarm will be generated for the port if the value is exceeded.
Transmitted Trace ID	Specify the path trace label. (J0 Tx Path Trace)
Expected Trace ID	Specify Expected the path trace label. (J0 Expected Path Trace)

3.7.2 VC-4

This web page allows user to set parameters of VC-4／VC-3.

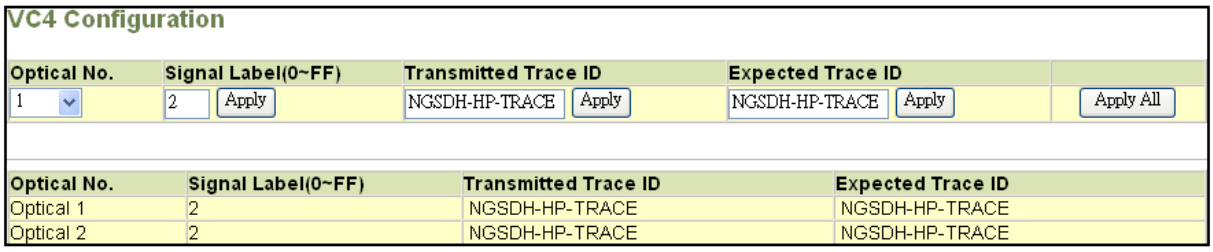


Figure 3-17 VC-4

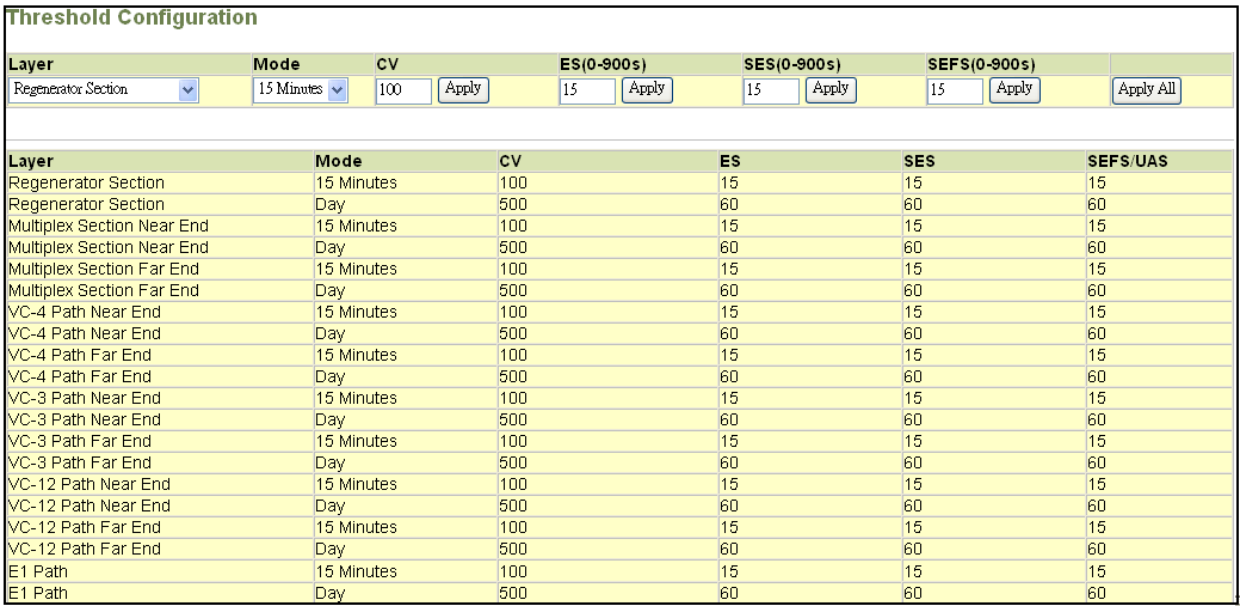
Table 3-4 Description of VC-4 function

Pull down menu	Description
Optical No.	User can choose which optical port that will be

	modified.
Signal Label（0~FF）	Specify the expected signal label (one byte)
Transmitted Trace ID	Specify the path trace label. (J1 Tx Path Trace)
Expected Trace ID	Specify Expected the path trace label. (J1 Expected Path Trace)

3.7.3 Threshold

This web page allows user to set the threshold of CV, ES, SES, and SEFS（UAS）.



Threshold Configuration

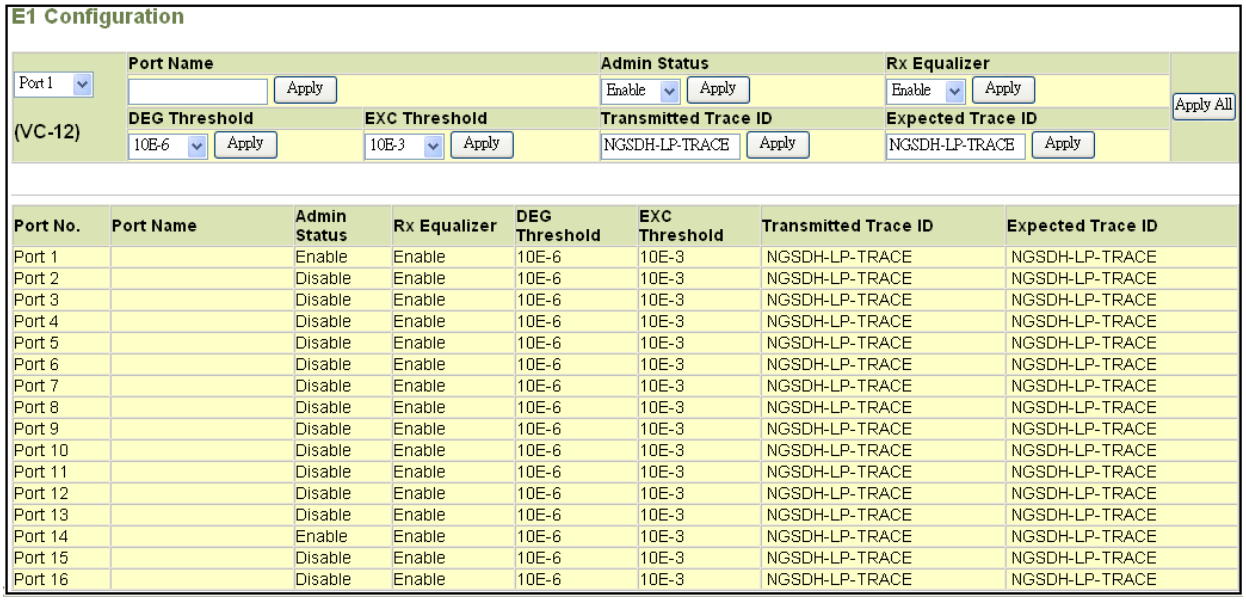
Layer	Mode	CV	ES(0-900s)	SES(0-900s)	SEFS(0-900s)	
Regenerator Section	15 Minutes	100 Apply	15 Apply	15 Apply	15 Apply	Apply All

Layer	Mode	CV	ES	SES	SEFS/UAS
Regenerator Section	15 Minutes	100	15	15	15
Regenerator Section	Day	500	60	60	60
Multiplex Section Near End	15 Minutes	100	15	15	15
Multiplex Section Near End	Day	500	60	60	60
Multiplex Section Far End	15 Minutes	100	15	15	15
Multiplex Section Far End	Day	500	60	60	60
VC-4 Path Near End	15 Minutes	100	15	15	15
VC-4 Path Near End	Day	500	60	60	60
VC-4 Path Far End	15 Minutes	100	15	15	15
VC-4 Path Far End	Day	500	60	60	60
VC-3 Path Near End	15 Minutes	100	15	15	15
VC-3 Path Near End	Day	500	60	60	60
VC-3 Path Far End	15 Minutes	100	15	15	15
VC-3 Path Far End	Day	500	60	60	60
VC-12 Path Near End	15 Minutes	100	15	15	15
VC-12 Path Near End	Day	500	60	60	60
VC-12 Path Far End	15 Minutes	100	15	15	15
VC-12 Path Far End	Day	500	60	60	60
E1 Path	15 Minutes	100	15	15	15
E1 Path	Day	500	60	60	60

Figure 3-18 Threshold

3.7.4 E1 Interface

This web page allows user to set parameters of E1 interface（VC-12）.



Port No.	Port Name	Admin Status	Rx Equalizer	DEG Threshold	EXC Threshold	Transmitted Trace ID	Expected Trace ID
Port 1		Enable	Enable	10E-6	10E-3	NGSDH-LP-TRACE	NGSDH-LP-TRACE
Port 2		Disable	Enable	10E-6	10E-3	NGSDH-LP-TRACE	NGSDH-LP-TRACE
Port 3		Disable	Enable	10E-6	10E-3	NGSDH-LP-TRACE	NGSDH-LP-TRACE
Port 4		Disable	Enable	10E-6	10E-3	NGSDH-LP-TRACE	NGSDH-LP-TRACE
Port 5		Disable	Enable	10E-6	10E-3	NGSDH-LP-TRACE	NGSDH-LP-TRACE
Port 6		Disable	Enable	10E-6	10E-3	NGSDH-LP-TRACE	NGSDH-LP-TRACE
Port 7		Disable	Enable	10E-6	10E-3	NGSDH-LP-TRACE	NGSDH-LP-TRACE
Port 8		Disable	Enable	10E-6	10E-3	NGSDH-LP-TRACE	NGSDH-LP-TRACE
Port 9		Disable	Enable	10E-6	10E-3	NGSDH-LP-TRACE	NGSDH-LP-TRACE
Port 10		Disable	Enable	10E-6	10E-3	NGSDH-LP-TRACE	NGSDH-LP-TRACE
Port 11		Disable	Enable	10E-6	10E-3	NGSDH-LP-TRACE	NGSDH-LP-TRACE
Port 12		Disable	Enable	10E-6	10E-3	NGSDH-LP-TRACE	NGSDH-LP-TRACE
Port 13		Disable	Enable	10E-6	10E-3	NGSDH-LP-TRACE	NGSDH-LP-TRACE
Port 14		Enable	Enable	10E-6	10E-3	NGSDH-LP-TRACE	NGSDH-LP-TRACE
Port 15		Disable	Enable	10E-6	10E-3	NGSDH-LP-TRACE	NGSDH-LP-TRACE
Port 16		Disable	Enable	10E-6	10E-3	NGSDH-LP-TRACE	NGSDH-LP-TRACE

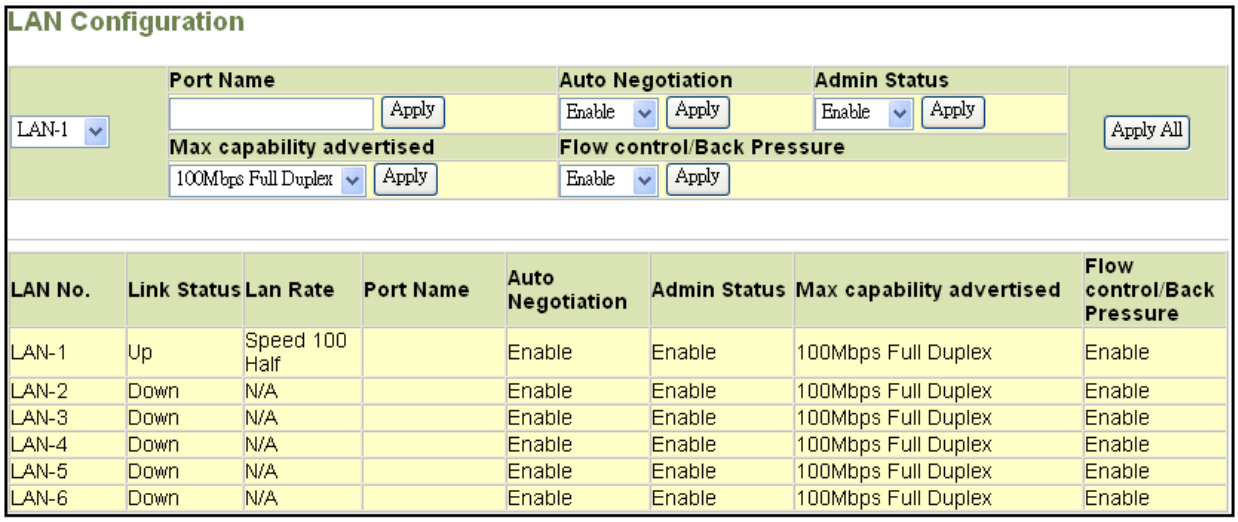
Figure 3-19 E1 Interface

Table 3-5 Description of E1 Interface function

Pull down menu	Description
VC-12	Choose which E1（VC-12） that will be modified.
Port Name	Use to enter a logical name for the E1 port.
Admin Status	Use to enable/disable the flow of traffic through the selected E1 port.
Rx Equalizer	Determine the maximum attenuation of the receive signal that can be compensated for by the port received path, to obtain the BER performance required by the standards.
DEG Threshold	Select the BER value; the signal-degraded alarm will be generated for the port if the value is exceeded.
EXC Threshold	Select the BER value; the error rate degradation alarm will be generated for the port if the value is exceeded.
Transmitted Trace ID	Specify the path trace label. (J2 Tx Path Trace)
Expected Trace ID	Specify Expected the path trace label. (J2 Expected Path Trace)

3.7.5 LAN Port

This web page allows user to set parameters of LAN Port.



LAN No.	Link Status	Lan Rate	Port Name	Auto Negotiation	Admin Status	Max capability advertised	Flow control/Back Pressure
LAN-1	Up	Speed 100 Half		Enable	Enable	100Mbps Full Duplex	Enable
LAN-2	Down	N/A		Enable	Enable	100Mbps Full Duplex	Enable
LAN-3	Down	N/A		Enable	Enable	100Mbps Full Duplex	Enable
LAN-4	Down	N/A		Enable	Enable	100Mbps Full Duplex	Enable
LAN-5	Down	N/A		Enable	Enable	100Mbps Full Duplex	Enable
LAN-6	Down	N/A		Enable	Enable	100Mbps Full Duplex	Enable

Figure 3-20 LAN Port

Table 3-6 Description of LAN Port function

Pull down menu	Description
LAN	Choose which LAN Port that will be modified.
Port Name	Use to enter a logical name for the LAN port.
Auto Negotiation	Use to enable/disable the Auto Negotiation function of LAN Port. Auto-negotiation is used to select automatically the mode providing the highest possible traffic handling capability
Admin Status	Use to enable/disable the flow of traffic through the selected LAN port.
Max capability advertised	Specify the highest traffic handling capability to be advertised during the auto-negotiation process. The operating mode selected as a result of auto-negotiation cannot exceed the advertised capability. This parameter is displayed only when auto-negotiation is enabled.
Flow control/back Pressure	Select the usage of flow control (when operating in the full duplex mode), or back pressure (when operating in the half-duplex mode)

3.7.6 VCG Group

This web page allows user to set parameters of VCG group.

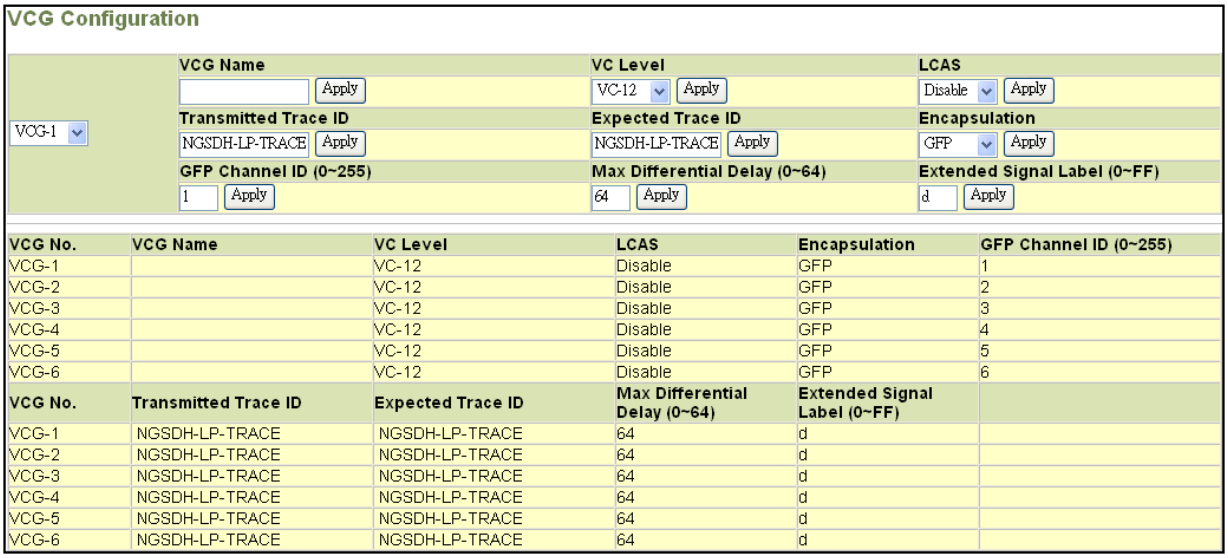

VCG Configuration
VCG-1
VCG Name
Apply
VC Level
VC-12
Apply
LCAS
Disable
Apply
Transmitted Trace ID
NGSDH-LP-TRACE
Apply
Expected Trace ID
NGSDH-LP-TRACE
Apply
Encapsulation
GFP
Apply
GFP Channel ID (0~255)
1
Apply
Max Differential Delay (0~64)
64
Apply
Extended Signal Label (0~FF)
d
Apply
VCG No. | VCG Name | VC Level | LCAS | Encapsulation | GFP Channel ID (0~255)
VCG-1 | | VC-12 | Disable | GFP | 1
VCG-2 | | VC-12 | Disable | GFP | 2
VCG-3 | | VC-12 | Disable | GFP | 3
VCG-4 | | VC-12 | Disable | GFP | 4
VCG-5 | | VC-12 | Disable | GFP | 5
VCG-6 | | VC-12 | Disable | GFP | 6
VCG No. | Transmitted Trace ID | Expected Trace ID | Max Differential Delay (0~64) | Extended Signal Label (0~FF)
VCG-1 | NGSDH-LP-TRACE | NGSDH-LP-TRACE | 64 | d
VCG-2 | NGSDH-LP-TRACE | NGSDH-LP-TRACE | 64 | d
VCG-3 | NGSDH-LP-TRACE | NGSDH-LP-TRACE | 64 | d
VCG-4 | NGSDH-LP-TRACE | NGSDH-LP-TRACE | 64 | d
VCG-5 | NGSDH-LP-TRACE | NGSDH-LP-TRACE | 64 | d
VCG-6 | NGSDH-LP-TRACE | NGSDH-LP-TRACE | 64 | d

Figure 3-21 VCG Group

Table 3-7 Description of VCG Group function

Pull down menu	Description
VCG	Choose which VCG that will be modified.
VC Level	Select the type of VC used to carry the corresponding virtually concatenated group. This parameter is one of the parameters that determine the bandwidth made available to the virtually concatenated group.
LCAS	Use to enable/disable use of the Link Capacity Adjustment Scheme (LCAS) on the corresponding group.
Transmitted Trace ID	Specify the path trace label（LAN port VC-12 use only）. J2 Tx Path Trace
Expected Trace ID	Specify Expected the path trace label（LAN port VC-12 use only）. J2 Expected Path Trace
Encapsulation	Select the method of encapsulation used by the virtually concatenated group.
GFP Channel ID（0~255）	Select the GFP channel identifier. This field is displayed only when GFP Encapsulation is used..
Max Differential Delay（0~64）	Select the maximum differential delay among the VCs carrying the selected group that can be corrected. A larger value increases the latency; therefore always select the minimum value that can compensate for the expected delay variation.

Extended Signal Label（0~FF）	Select the extended signal label, which is part of the SDH overhead when virtual concatenation is used.

3.7.7 GFP Group

This web page allows user to set parameters of GFP group.

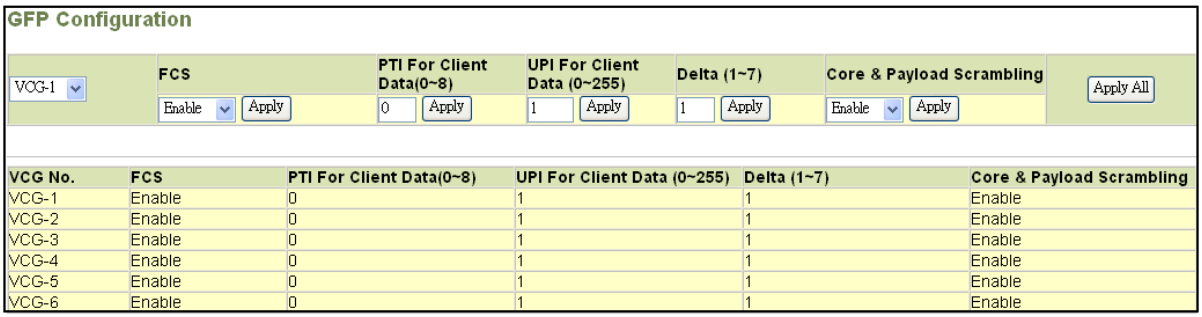


Figure 3-22 GFP Group

Table 3-8 Description of GFP Group function

Pull down menu	Description
VCG	Choose which VCG that will be modified.
FCS	Control the use of error detection for the payload.
PTI For Client Data（0~8）	Select the payload type identifier (PTI) inserted in GFP frames.
UPI For Client Data（0~255）	Select the user payload identifier (PTI) inserted in GFP frames.
Delta（1~7）	Select the number of error-free frame headers that must be received before frame synchronization is declared.
Core & Payload Scrambling	Control the use of frame core and payload data scrambling.

3.7.8 GFP Multiplexer

This web page allows user to set parameters of GFP multiplexer. Configure GFP multiplexing parameters. A GFP multiplexer can handle up to four virtually concatenated groups.

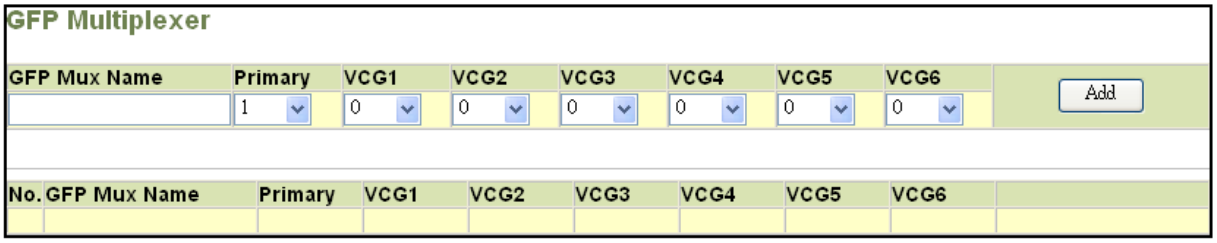


Figure 3-23 GFP Multiplexer

Table 3-9 Description of GFP Multiplexer function

Pull down menu	Description
GFP Mux Name	Use to assign a logical name to the GFP multiplexer.
Primary	The virtually concatenated group that serves as the transport group of the GFP multiplexer output.
VCG1~ VCG6	The number indicates the fraction of the total bandwidth guaranteed to the corresponding group. The total bandwidth available to the GFP multiplexer output is the bandwidth configured for the primary virtually concatenated group.

3.7.9 LAPS Group

This web page allows user to set parameters of LAPS group. These parameters are relevant only when LAPS encapsulation is used for at least one virtually concatenated group.

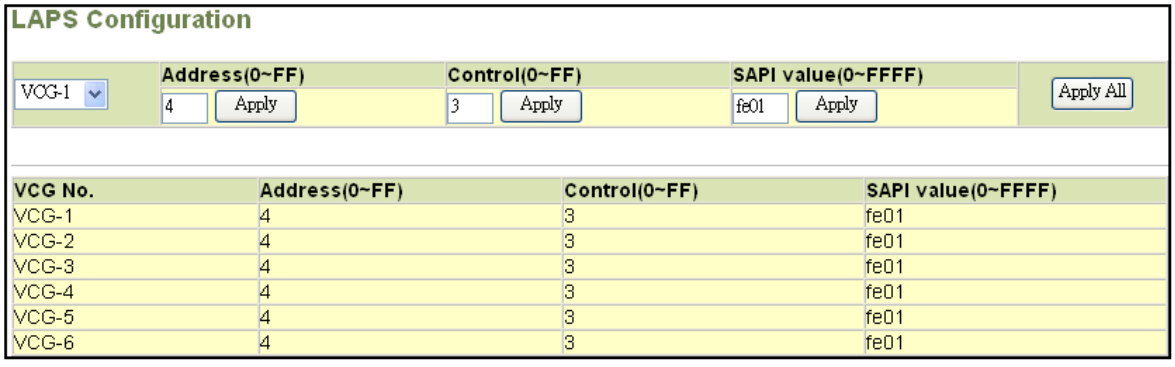


Figure 3-24 LAPS Group

Table 3-10 Description of LAPS Group function

Pull down menu	Description
VCG	Choose which VCG that will be modified.
Address（0~FF）	Select the HDLC address to be used by the LAPS

	protocol for handshaking. The standard HDLC address for the Ethernet encapsulated with LAPS is 4.
Control（0~FF）	Select the HDLC control address to be used by the LAPS protocol for handshaking. The standard HDLC control value for the Ethernet encapsulated with LAPS is 3.
SAPI value（0~FFFF）	Select the service access point identifier (SAPI) for the LAPS protocol. The standard SAPI for the Ethernet MAC is FE01.

3.7.10 Cross Connect

This web page allows user to set Cross Connect. Map the payload from the various MUXpro interfaces to specific TUs, for transmission through the SDH link.

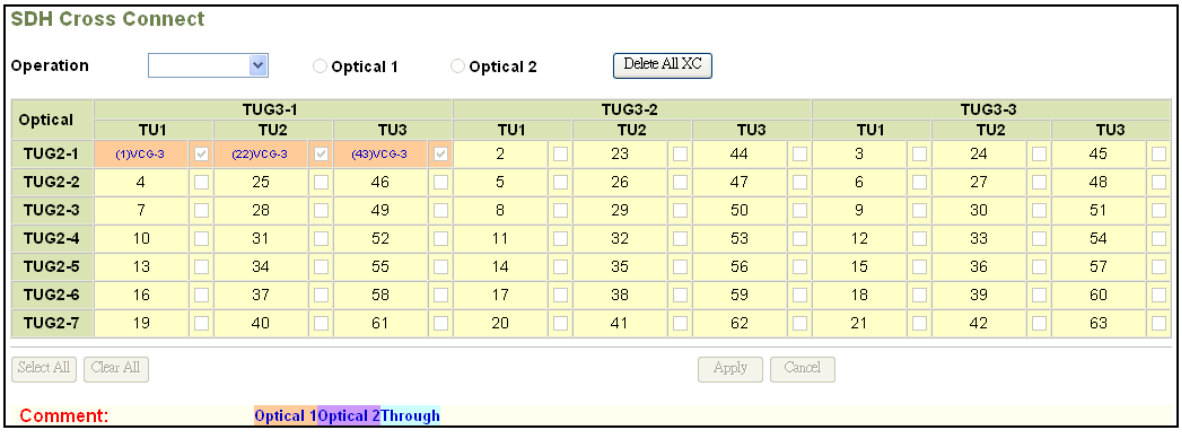


Figure 3-25 Cross Connect

Table 3-11 Description of Cross Connect function

Pull down menu	Description
Operation	Choose which VCG or E1 that will be mapped
Optical 1 & 2	If the Protection is disabled, user can choose which optical port to be used.

3.7.11 Protection

This web page allows user to set Protection function.

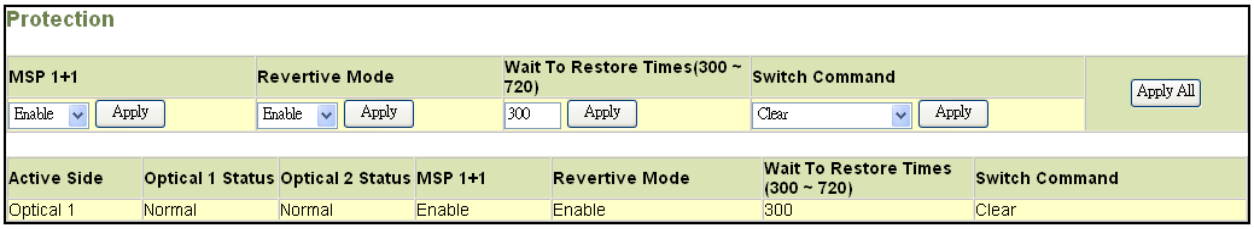


Figure 3-26 Protection

Table 3-12 Description of Protection function

Pull down menu	Description
MSP 1+1	Control the use of MSP 1+1 protection switching on the link to the SDH network
Revertive Mode	As the Optical 1 being unplugged or disconnected, the system will automatically switch to Optical 2 for backup. If this function Enable, as soon as the Optical 1 is back in service for over the “Wait To Restore Times”, the system will switch the traffic back to Optical 1 from Optical 2.
Wait To Restore Times（300~720）	When protection switching is enabled and a link interface becomes active, specify the duration of time during which all the alarms reported by the framer will be ignored.
Switch Command	There are four command can be used to test the connection：Clear, Lockout of Protection, Force Switch, and Manual Switch.

3.7.12 Synchronization

This web page allows user to set the parameters of clock.

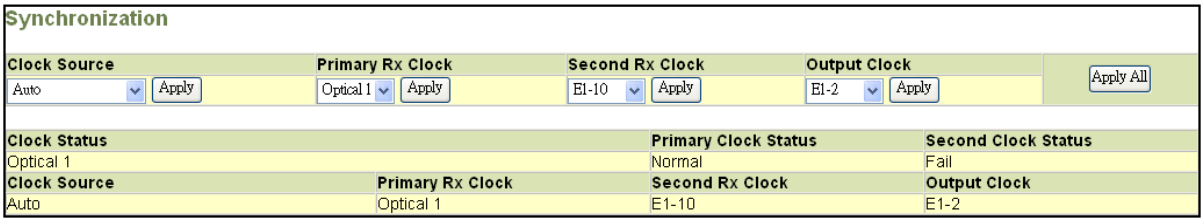


Figure 3-27 Synchronization

Table 3-13 Description of Synchronization function

Pull down menu	Description
Clock Source	There are four options：Auto, Primary Rx Clock, Second Rx Clock, and Internal.
Primary Rx Clock	There are nineteen options：E1-1 to E1-16, Optical 1 to 2, and none.
Second Rx Clock	There are nineteen options：E1-1 to E1-16, Optical 1 to 2, and none.
Output Clock	There are seventeen options：E1-1 to E1-16, and none.

3.7.13 Bridge

This section introduces the “Bridge” functions. The “Bridge” functions include “General Setup”, “DSCP”, “MAC Table”, “Port Bridge Config”, “Port Base VLAN”, “Tag Base VLAN”, “VLAN Tag Priority”, “Spanning Tree”.

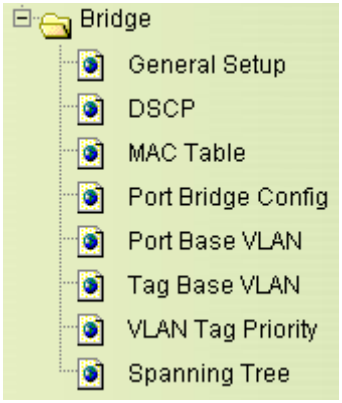


Figure 3-28 Bridge functions

3.7.13.1 General Setup

“General Setup” functions include Aging Time, Qos Mode, and Scheduling Mode.

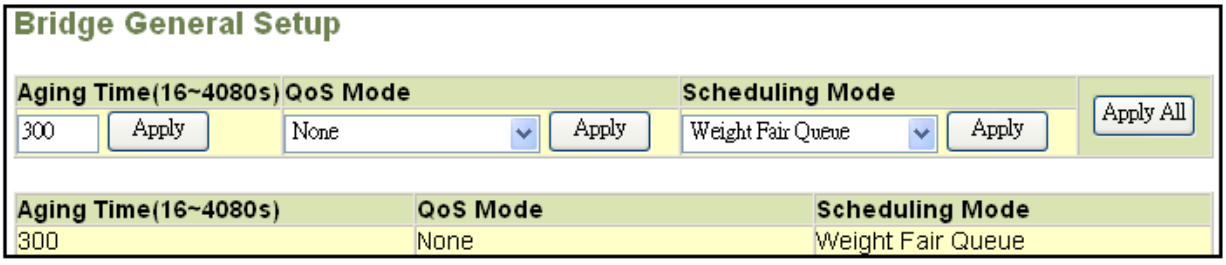


Figure 3-29 General Setup

Table 3-14 Description of General Setup function

Pull down menu	Description
Aging Time （16~4080s）	Select the maximum time learned MAC destination addresses are stored.
QoS Mode	Specify the QoS criteria for directing frames to the four prioritized egress queues of the Ethernet switch.
Scheduling Mode	Select the frame egress scheduling mode when QoS support is enabled

3.7.13.2 DSCP

This web page allows user to set priority of DSCP. The priority “3” is the highest priority.

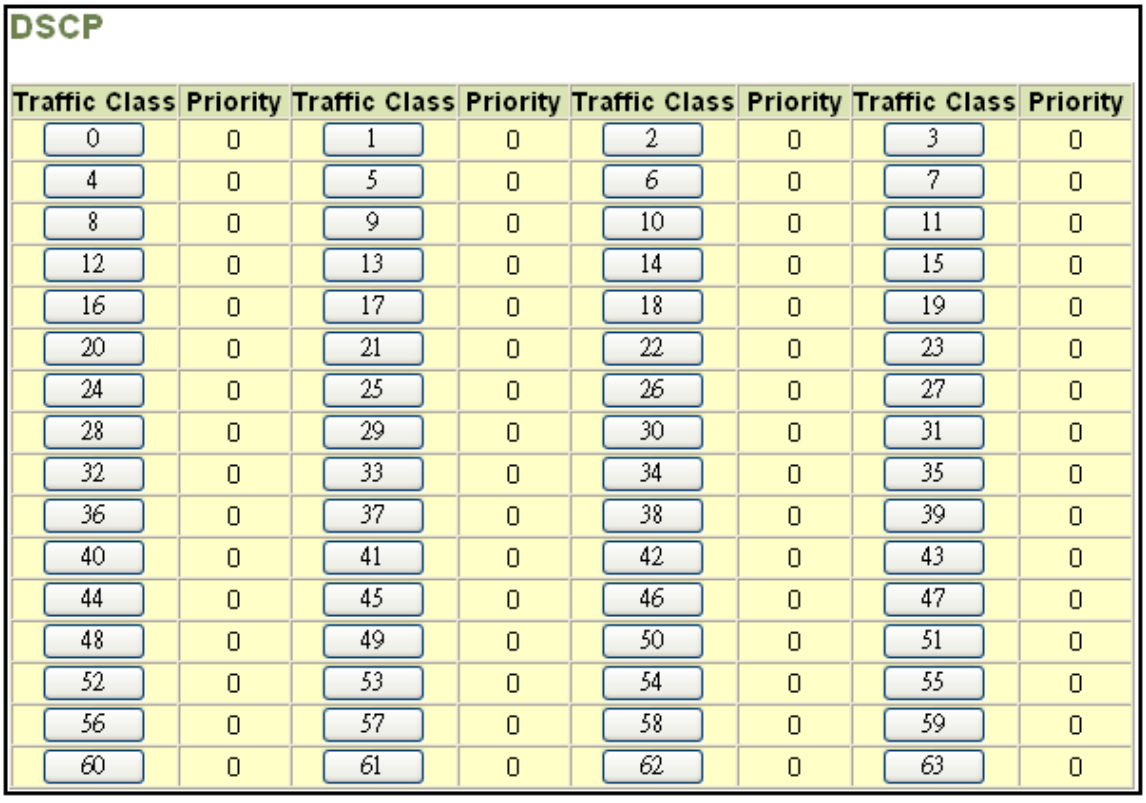


Figure 3-30 DSCP

3.7.13.3 MAC Table

This web page allows user to set static MAC mapping of LAN Ports

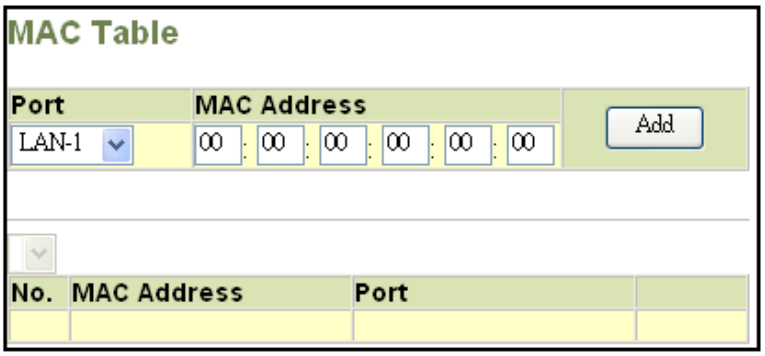
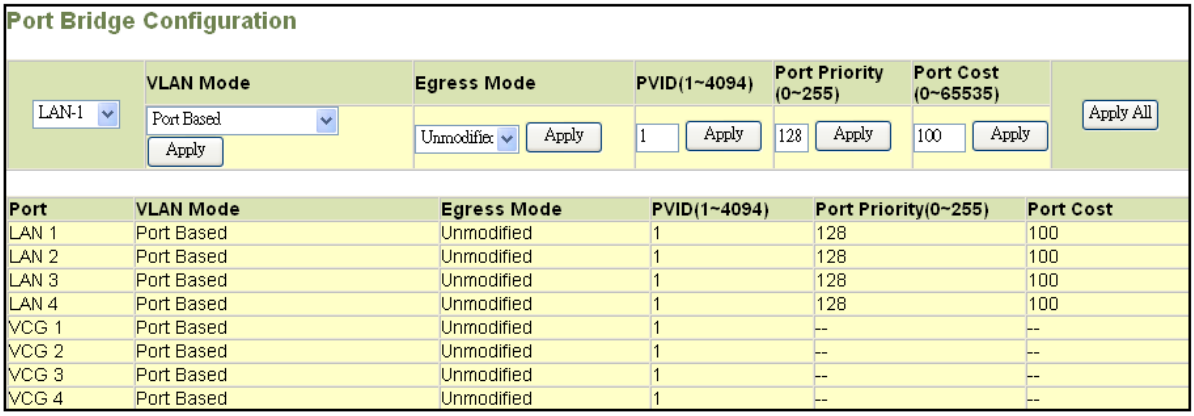


Figure 3-31 MAC Table

3.7.13.4 Port Bridge Config

This web page allows user to set parameters of VLAN of LAN ports.



Port	VLAN Mode	Egress Mode	PVID(1~4094)	Port Priority(0~255)	Port Cost
LAN 1	Port Based	Unmodified	1	128	100
LAN 2	Port Based	Unmodified	1	128	100
LAN 3	Port Based	Unmodified	1	128	100
LAN 4	Port Based	Unmodified	1	128	100
VCG 1	Port Based	Unmodified	1	--	--
VCG 2	Port Based	Unmodified	1	--	--
VCG 3	Port Based	Unmodified	1	--	--
VCG 4	Port Based	Unmodified	1	--	--

Figure 3-32 Port Bridge Config

Table 3-15 Description of Port Bridge Config function

Pull down menu	Description
LAN	Choose which LAN port to be modified.
VLAN Mode	Select the type of VLAN in which the port participates, and the frame-processing mode.
Egress Mode	Specify the egress mode for the corresponding port of the Ethernet switch.
PVID（1~4094）	Specify the default VLAN ID (VID) associated with the corresponding port.
Port Priority （0~255）	Specify the port priority, used by STP to generate the port ID.
Port Cost （0~65535）	Specify the cost added by the port to the total cost to the root bridge.

3.7.13.5 Port Base VLAN

This web page allows user to set which LAN combine with VCG or MGN port.

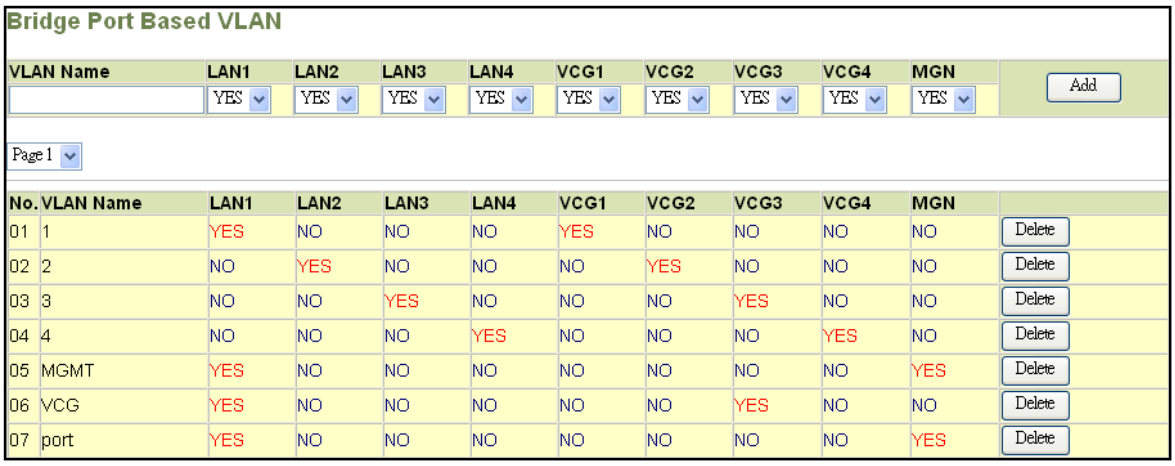

Bridge Port Based VLAN
VLAN Name
LAN1
LAN2
LAN3
LAN4
VCG1
VCG2
VCG3
VCG4
MGN
Add
YES
Page 1
No.
VLAN Name
Delete
01 1 YES NO NO NO YES NO NO NO NO
02 2 NO YES NO NO NO YES NO NO NO
03 3 NO NO YES NO NO NO YES NO NO
04 4 NO NO NO YES NO NO NO YES NO
05 MGMT YES NO NO NO NO NO NO NO YES
06 VCG YES NO NO NO NO NO YES NO NO
07 port YES NO NO NO NO NO NO NO YES

Figure 3-33 Port Base VLAN

3.7.13.6 Tag Base VLAN

This web page allows user to set static tag-based switching for the egress LAN ports.

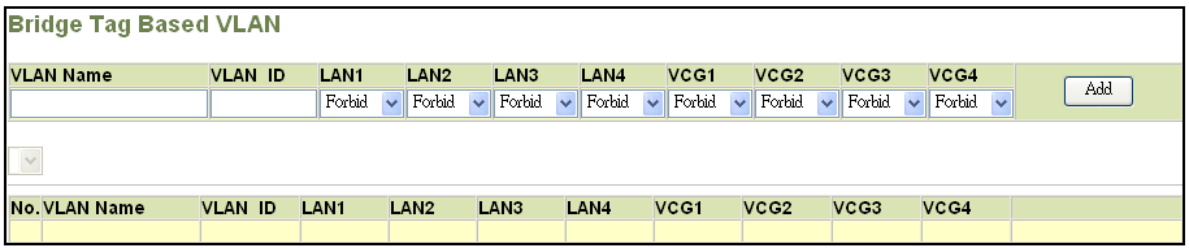


Figure 3-34 Tag Base VLAN

3.7.13.7 VLAN Tag Priority

This web page allows user to set the egress priority of the frames. The priority “3” is the highest priority.

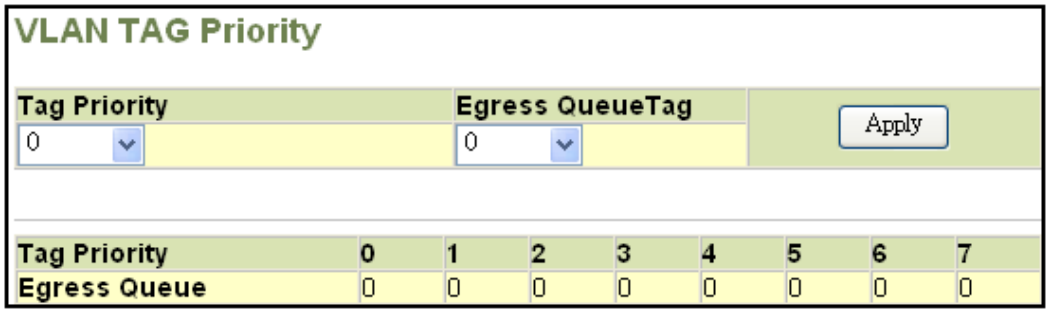


Figure 3-35 VLAN Tag Priority

3.7.13.8 Spanning Tree

This web page allows user to set the Spanning Tree Protocol parameters in accordance with the specific requirements of the customer’s application. When the STP Mode is set to Enable, it takes effect on LAN port 1 to 4 and the LAN port status can be checked in this page.

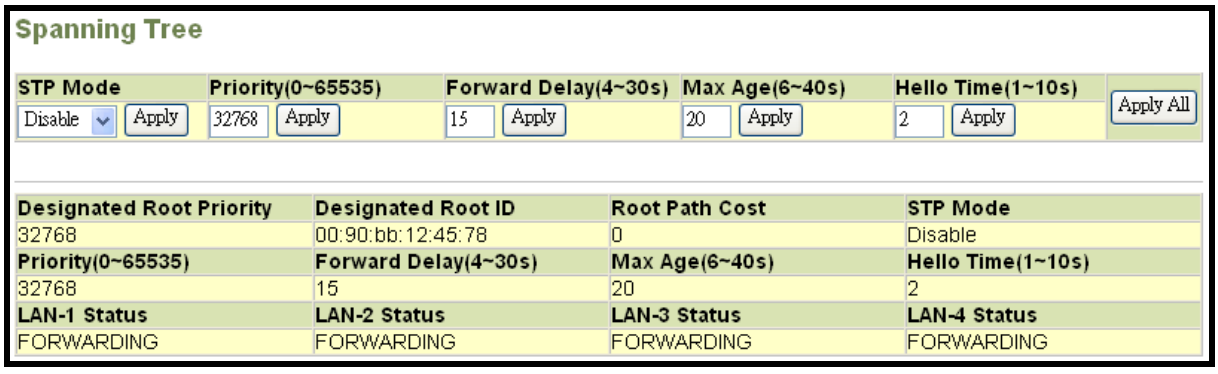


Figure 3-36 Spanning Tree

Table 3-16 Description of Spanning Tree function

Pull down menu	Description
STP Mode	Use to enable/disable Spanning Tree function.
Priority（0~65535）	Specify the bridge priority.
Forward Delay （4~30s）	Specify the time spent in the listening and in the learning state while moving from the Blocking to the Forwarding state.
Max Age（6~40s）	Specify the maximum age of received protocol information before it is discarded.
Hello Time（1~10s）	Specify the time interval between consecutive transmissions of bridge protocol data units (BPDUs).

Chapter 4. Monitoring and Maintenance

4.1 Scope

This chapter provides instructions for obtianing information about alarm message, performance monitoring and loop testing function for diagnostic. Users can see the details in the sections below.

4.2 "System Monitor" Main function Group Description

This section introduces the sub-functions of "System Monitor" Main function. The "System Monitor" main function includes "Trace_ID & Signal Label" and "VCG LCAS" functions.

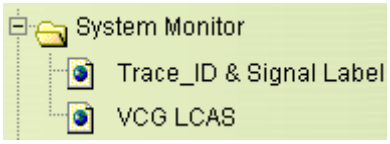


Figure 4-1 The Sub-functions of System Monitor Main Function Group

4.2.1 Trace_ID & Signal Label

The web page allows user to check parameters of connection.

Trace ID & Signal Label Refresh Now

Section	Transmitted Trace ID	Expected Trace ID	Received Trace ID
Optical 1	NGSDH-RS-TRACE	NGSDH-RS-TRACE	NGSDH-RS-TRACE
Optical 2	NGSDH-RS-TRACE	NGSDH-RS-TRACE	NGSDH-RS-TRACE

VC4	Transmitted Trace ID	Expected Trace ID	Received Trace ID	Transmitted C2	Expected C2	Received C2
Optical 1	NGSDH-HP-TRACE	NGSDH-HP-TRACE	NGSDH-HP-TRACE	2	2	2
Optical 2	N/A	N/A	N/A	N/A	N/A	N/A

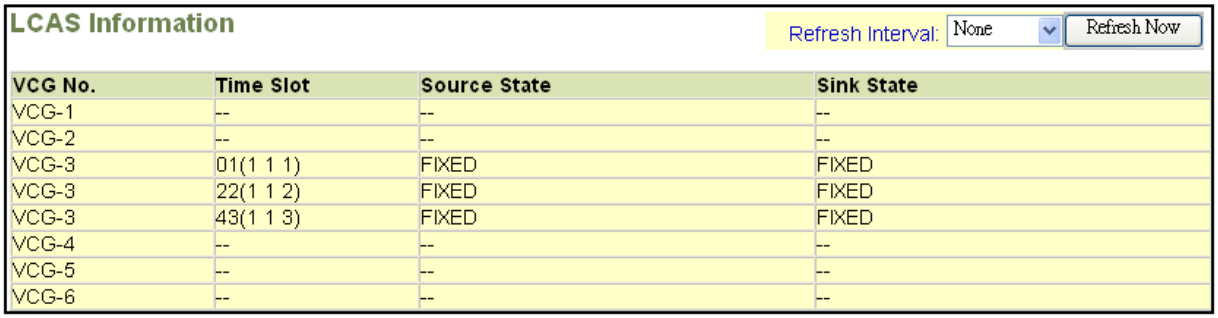
VC3	Transmitted Trace ID	Expected Trace ID	Received Trace ID	Transmitted C2	Expected C2	Received C2
1	N/A	N/A	N/A	N/A	N/A	N/A
2	N/A	N/A	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A	N/A	N/A

VC12	Transmitted Trace ID	Expected Trace ID	Received Trace ID	Received V5	Transmitted C2	Expected C2	Received C2
1	NGSDH-LP-TRACE	NGSDH-LP-TRACE	NGSDH-LP-TRACE	a	d	d	d
22	NGSDH-LP-TRACE	NGSDH-LP-TRACE	NGSDH-LP-TRACE	8a	d	d	d
43	NGSDH-LP-TRACE	NGSDH-LP-TRACE	NGSDH-LP-TRACE	a	d	d	d

Figure 4-2 Trace ID and Signal Label

4.2.2 VCG LCAS

The web page allows user to check VCG status.



LCAS Information

Refresh Interval: None Refresh Now

VCG No.	Time Slot	Source State	Sink State
VCG-1	--	--	--
VCG-2	--	--	--
VCG-3	01(1 1 1)	FIXED	FIXED
VCG-3	22(1 1 2)	FIXED	FIXED
VCG-3	43(1 1 3)	FIXED	FIXED
VCG-4	--	--	--
VCG-5	--	--	--
VCG-6	--	--	--

Figure 4-3 VCG LCAS

4.3 "Fault Monitor" Main function Group Description

This section introduces the sub-functions of "Fault Monitor" Main function. The "Fault Monitor" main function includes "System Alarm" and "Alarm Log" functions.

Figure 4-4 The Sub-functions of Fault Monitor Main Function Group

Table 4-1 shows the alarm messages generated by the SDH, specifies their class (Major or Minor), type (Alarm, Performance Monitoring and State), and explains their meaning.

Table 4-1 SDH Alarm Messages

Message	Description	Corrective Actions	Type	Class
STM1_LOS	Loss of signal	1. Check cable connections to the link connector. 2. Check line and/or other communication equipment providing the link to the specified Optical module. 3. Replace the Optical	Alarm	Major

Message	Description	Corrective Actions	Type	Class
		module.		
STM1_LOF	Loss of frame	Clean up the Optical fiber	Alarm	Major
STM1_OOF	Out of Frame–A1, A2 incorrect for >= 625 us	OOF state exited when 4 consecutive SDH frames are received with valid framing patterns	Alarm	Major
STM1_RS_TIM	Regenerator section trace identifier mismatch	Check Regenerator section Received trace identifier and Expected trace identifier setting	Alarm	Minor
STM1_MS_AIS	Multiplex section AIS	Check the higher layer alarms	Alarm	Major
STM1_MS_RDI	Multiplex section remote defect indication	Check Multiplex section alarm of FAR END	Alarm	Minor
STM1_MS_EXC	Multiplex section Excessive Errors	Informative alert	Alarm	Major
STM1_MS_DEG	Multiplex section Degraded	Informative alert	Alarm	Minor
STM1_AU_AIS	Administrative unit AIS	Check the higher layer alarms	Alarm	Major
STM1_AU_LOP	Administrative unit loss of pointer	Check Cross Connect setting of FAR END	Alarm	Major
STM1_HP_UNEQ	HO path unequipped	Check the signal label of received V5 byte	Alarm	Minor
STM1_HP_TIM	HO path trace identifier mismatch	Check HO path Received trace identifier and Expected trace identifier setting	Alarm	Minor
STM1_HP_RDI	HO path remote defect indication	Check HO path alarm of FAR END	Alarm	Minor
STM1_HP_EXC	Higher Order Path Excessive Errors	Informative alert	Alarm	Major
STM1_HP_DEG	Higher Order Path Degraded	Informative alert	Alarm	Minor

Message	Description	Corrective Actions	Type	Class
STM1_TU_AIS	Tributary unit AIS	Check the higher layer alarms	Alarm	Major
STM1_TU_LOP	Loss of pointer	Check Cross Connect setting of FAR END	Alarm	Major
STM1_HP_LOM	Loss of multi-frames	Informative alert	Alarm	Major
STM1_HP_PLM	HO path payload label mismatch	Check the received C2 byte	Alarm	Minor
STM1_LP_UNEQ	LO path unequipped	Check the signal label of received V5 byte	Alarm	Minor
STM1_LP_TIM	LO path trace identifier mismatch	Check LO path Received trace identifier and Expected trace identifier setting	Alarm	Minor
STM1_LP_PLM	LO path payload label mismatch	Check the received C2 byte	Alarm	Minor
STM1_LP_RDI	LO path remote defect indication	Check LO path alarm of FAR END	Alarm	Minor
GFP_CH_ID_mismatch	Channel ID mismatch for primary VCG within GFP MUX	Check Channel ID setting for primary VCG within GFP MUX	Warning	
RX_LCAS_CRC_error	Received CRC error in LCAS mode	Informative alert	Warning	
RX_LAPS_Frame_mismatch	Received Frame mismatch for LAPS Encapsulation	Check Encapsulation setting for VCG#	Alarm	Minor
GFP_loss_of_sync	loss of sync for GFP Encapsulation	Check Encapsulation setting for VCG#	Alarm	Major
Diff_delay_exceeds_Max	Differential delay exceeding the Maximum (loss of alignment)	Informative alert	Warning	
VCG_VC_LP_LO	Loss Of	Informative alert	Alarm	Major

Message	Description	Corrective Actions	Type	Class
M	Multi-frames defect			
TX_LCAS_ADD_NOR_timeout	Defect of RS_NORMAL after ADD	Informative alert	Event	
TX_LCAS_ADD_ACK_timeout	Defect of RS_ACK after ADD	Informative alert	Event	

Table 4-2 shows the alarm messages generated by the E1 module, specifies their class (major or minor), type (alarm or performance monitoring), and explains their meaning.

Table 4-2 E1 Alarm Messages

Message	Description	Corrective Actions	Type	Class
ET1_LOS	Loss of Synchronous – Local lost of multi-frame synchronization alarm on the specified link	1. Check cable connections to the link connector. 2. Check line and/or other communication equipment providing the link to the specified E1 module. 3. Replace the E1 module.	Alarm	Major
ET1_AIS	E1 AIS	Informative alert.	Alarm	Major
ES_QTR_TCA	Error Seconds – Counting Error Seconds over 15 -minute threshold.	Informative alert.	P.M.	Minor
SES_QTR_TCA	Severely Error Seconds – Counting Severe Error Seconds over 15-minute threshold.	Informative alert.	P.M.	Major
UAS_QTR_TCA	Unavailable Second – Counting Unavailable Second over 15-minute	Informative alert.	P.M.	Major

Message	Description	Corrective Actions	Type	Class
	threshold.			
SEFS_QTR_TCA	Severely Error Frame Second– Counting Severely Error Frame Second over 15-minute threshold.	Informative alert.	P.M.	Major
ES_DAY_TCA	Error Seconds – Counting Error Seconds over 1 day threshold.	Informative alert.	P.M.	Minor
SES_DAY_TCA	Severely Error Seconds – Counting Severely Error Seconds over 1 day threshold.	Informative alert.	P.M.	Major
UAS_DAY_TCA	Unavailable Second – Counting Unavailable Second over 1 day threshold.	Informative alert.	P.M.	Major
SEFS_DAY_TCA	Severely Error Frame Second– Counting Severely Error Frame Second over 1 day threshold.	Informative alert.	P.M.	Major
CV_QTR_TCA	15 Minutes Code/Bipolar Violation – Code/Bipolar Violation over specify threshold.	Informative alert.	P.M.	Minor
CV_DAY_TCA	1 day Code/Bipolar Violation – Code/Bipolar Violation over specify threshold.	Informative alert.	P.M.	Minor

Table 4-3 lists the alarm messages generated by the System module, specifies their class (major or minor), type (alarm, warning, event), and explains their meaning.

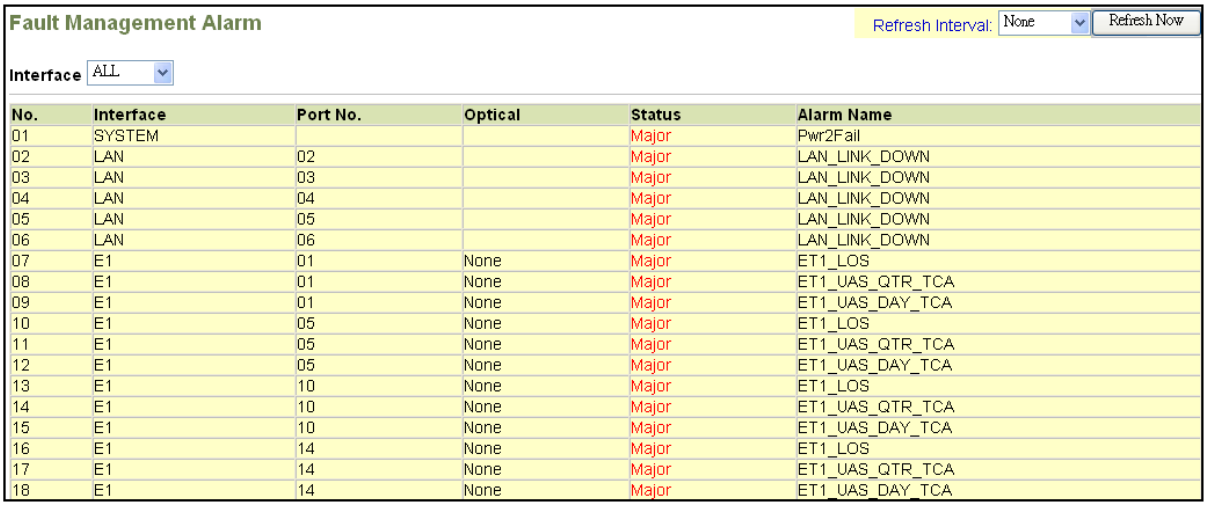
Table 4-3 System Alarm Messages

Message	Description	Corrective Actions	Type	Class
ClkPriOver Range	Primary Reference Out of Range–which the Primary Reference is off the PLL centre frequency by more than±12ppm.	Check Primary Reference Clock source	Warning	
ClkSecOve rRange	Secondary Reference Out of Range –which the Secondary Reference is off the PLL centre frequency by more than±12ppm.	Check Secondary Reference Clock source	Warning	
ClkHoldOv er	Indicates that the device is in Holdover mode.	Check Primary and Secondary Reference Clock source	Warning	
ClkLock	Indicates that the device is locked to the input reference.	Informative alert.	Warning	
FeCardFail	Fast Ethernet Daughter board's fail signal	Check Fast Ethernet Daughter board Replace Fast Ethernet Daughter board	Alarm	Major
Fan1Fail	FAN1's fail signal	Check FAN1 Replace FAN1	Alarm	Major
Fan2Fail	FAN2's fail signal	Check FAN2 2. Replace FAN2	Alarm	Major
Pwr1Fail	Power1's fail signal	Check Power1 Replace Power1	Alarm	Major
Pwr2Fail	Power2's fail signal	Check Power2 Replace Power2	Alarm	Major

Message	Description	Corrective Actions	Type	Class
E1CardFail	E1 Daughter board's fail signal	Check E1 Daughter board Replace E1 Daughter board	Alarm	Major
E1CardInserted	E1 Daughter board has been inserted	Informative alert.	Warning	
E1CardRemoved	E1 Daughter board has been removed	Informative alert.	Warning	

4.3.1 System Alarm

The web page allows user to check the current alarm.



No.	Interface	Port No.	Optical	Status	Alarm Name
01	SYSTEM			Major	Pwr2Fail
02	LAN	02		Major	LAN_LINK_DOWN
03	LAN	03		Major	LAN_LINK_DOWN
04	LAN	04		Major	LAN_LINK_DOWN
05	LAN	05		Major	LAN_LINK_DOWN
06	LAN	06		Major	LAN_LINK_DOWN
07	E1	01	None	Major	ET1_LOS
08	E1	01	None	Major	ET1_UAS_QTR_TCA
09	E1	01	None	Major	ET1_UAS_DAY_TCA
10	E1	05	None	Major	ET1_LOS
11	E1	05	None	Major	ET1_UAS_QTR_TCA
12	E1	05	None	Major	ET1_UAS_DAY_TCA
13	E1	10	None	Major	ET1_LOS
14	E1	10	None	Major	ET1_UAS_QTR_TCA
15	E1	10	None	Major	ET1_UAS_DAY_TCA
16	E1	14	None	Major	ET1_LOS
17	E1	14	None	Major	ET1_UAS_QTR_TCA
18	E1	14	None	Major	ET1_UAS_DAY_TCA

Figure 4-5 System Alarm

4.3.2 Alarm Log

This web page allows user to check alarm history.

Fault Management Alarm Log

Refresh Now

Page 1 | Clear All Log

No.	Interface	Port No.	Optical	Status	Alarm Name	Date/Time
001	E1	14	None	Major	ET1_UAS_QTR_TCA	2007/12/06 13:23:30
002	E1	10	None	Major	ET1_UAS_QTR_TCA	2007/12/06 13:23:29
003	E1	05	None	Major	ET1_UAS_QTR_TCA	2007/12/06 13:23:29
004	E1	01	None	Major	ET1_UAS_QTR_TCA	2007/12/06 13:23:29
005	E1	14	Opt1	Clear	ET1_UAS_QTR_TCA	2007/12/06 13:23:15
006	E1	10	Opt1	Clear	ET1_UAS_QTR_TCA	2007/12/06 13:23:14
007	E1	05	Opt1	Clear	ET1_UAS_QTR_TCA	2007/12/06 13:23:14
008	E1	01	Opt1	Clear	ET1_UAS_QTR_TCA	2007/12/06 13:23:14
009	E1	14	None	Major	ET1_UAS_QTR_TCA	2007/12/06 13:08:30
010	E1	10	None	Major	ET1_UAS_QTR_TCA	2007/12/06 13:08:29
011	E1	05	None	Major	ET1_UAS_QTR_TCA	2007/12/06 13:08:29
012	E1	01	None	Major	ET1_UAS_QTR_TCA	2007/12/06 13:08:29
013	E1	14	Opt1	Clear	ET1_UAS_QTR_TCA	2007/12/06 13:08:15
014	E1	10	Opt1	Clear	ET1_UAS_QTR_TCA	2007/12/06 13:08:14
015	E1	05	Opt1	Clear	ET1_UAS_QTR_TCA	2007/12/06 13:08:14
016	E1	01	Opt1	Clear	ET1_UAS_QTR_TCA	2007/12/06 13:08:14
017	E1	14	None	Major	ET1_UAS_QTR_TCA	2007/12/06 12:53:30
018	E1	10	None	Major	ET1_UAS_QTR_TCA	2007/12/06 12:53:29
019	E1	05	None	Major	ET1_UAS_QTR_TCA	2007/12/06 12:53:29
020	E1	01	None	Major	ET1_UAS_QTR_TCA	2007/12/06 12:53:29
021	E1	14	Opt1	Clear	ET1_UAS_QTR_TCA	2007/12/06 12:53:15
022	E1	10	Opt1	Clear	ET1_UAS_QTR_TCA	2007/12/06 12:53:14
023	E1	05	Opt1	Clear	ET1_UAS_QTR_TCA	2007/12/06 12:53:14
024	E1	01	Opt1	Clear	ET1_UAS_QTR_TCA	2007/12/06 12:53:14
025	E1	14	None	Major	ET1_UAS_QTR_TCA	2007/12/06 12:38:30
026	E1	10	None	Major	ET1_UAS_QTR_TCA	2007/12/06 12:38:29
027	E1	05	None	Major	ET1_UAS_QTR_TCA	2007/12/06 12:38:29
028	E1	01	None	Major	ET1_UAS_QTR_TCA	2007/12/06 12:38:29
029	E1	14	Opt1	Clear	ET1_UAS_QTR_TCA	2007/12/06 12:38:15
030	E1	10	Opt1	Clear	ET1_UAS_QTR_TCA	2007/12/06 12:38:14

Figure 4-6 Alarm Log

4.4 “Performance Monitor” Main function Group Description

This section introduces the sub-functions of “Performance Monitor” Main function. The “Performance Monitor” main function includes “Section”, “VC-4”, “VC-3”, “VC-12”, and “E1” submenus.

This Statistics include the statistics of CV, ES, SES, and SEFS/UAS of near end and far end, it includes 15 mins and 1 day statistics of current and history data.

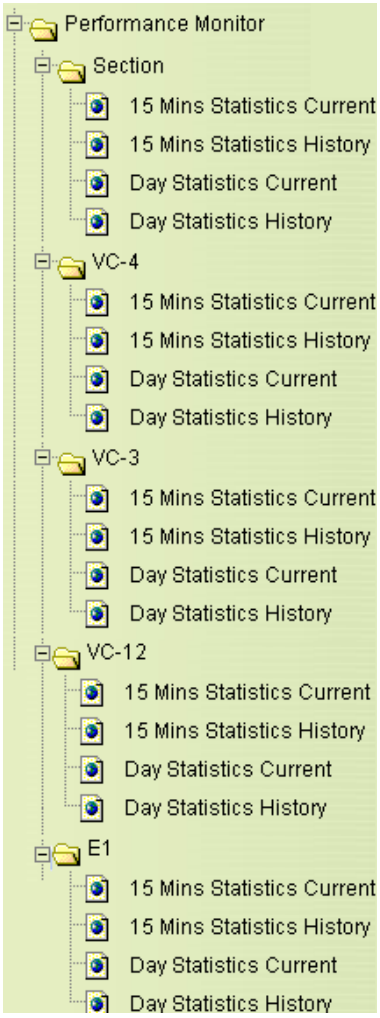


Figure 4-7 The Sub-functions of Performance Monitor Main Function Group

Table 4-4 describes the performance evaluation and monitoring functions provided by the MUXpro.

The performance parameters defined for MUXpro statistics are listed below:

Table 4-4 PM Messages

CV	BIP-8 errors， RS：B1 byte MS：B2 bytes Path：B3 byte VC：BIP-2 in the V5 byte
ES	At each layer, an Error Second (ES) is a second with one or more Coding Violations at that layer OR one or more incoming defects (e.g., SEF, LOS, AIS, LOP) at that layer has occurred.
SES	A Severely Error Second (SES) is a second with x or more CVs at that layer, or a second during which at least one or more incoming defects at that layer has occurred.
SEFS	A Severely Error Framing Second (SEFS) is a second containing one or more SEF events.
UAS	An unavailable second is calculated by counting the number of seconds that the interface is unavailable. The SONET/SDH interface is set to be unavailable at the onset of 10 contiguous SESs. Once unavailable, the SONET/SDH interface becomes available at the onset of 10 contiguous seconds with no SESs. A special case exists when the 10 second period leading to available or unavailable time crosses a 900 second statistics window boundary, as the foregoing description implies that the CV, ES, SES, SEFS, and UAS counts the PREVIOUS interval must be adjusted.

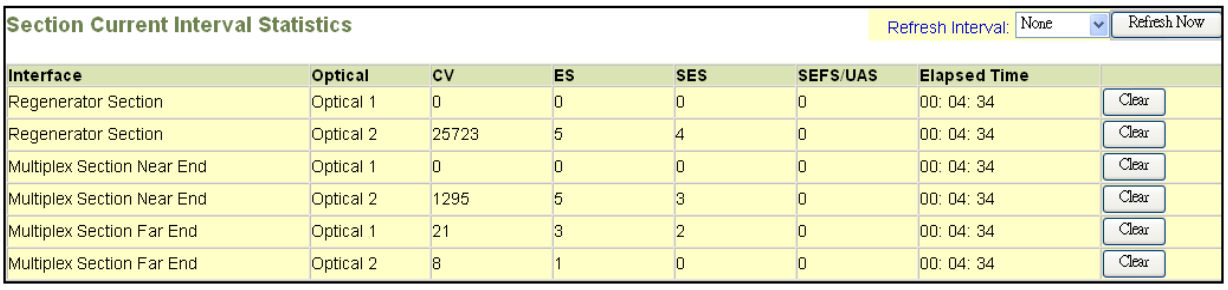
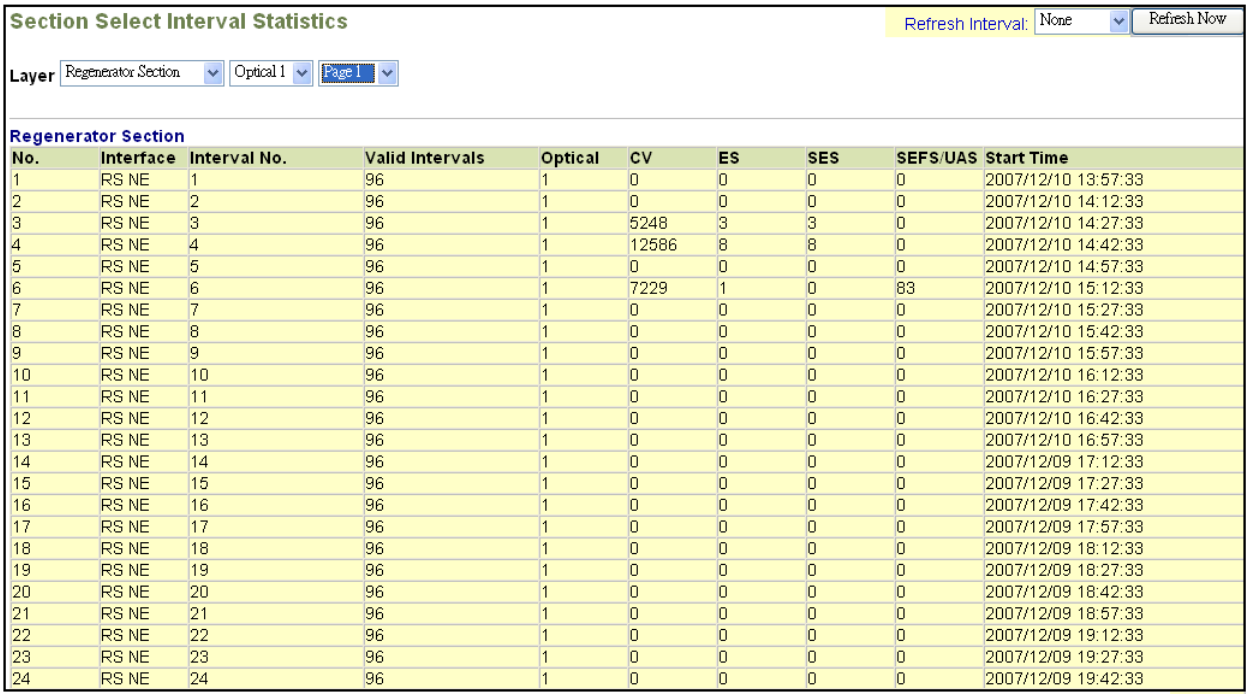

Section Current Interval Statistics
Refresh Interval: None
Refresh Now
Interface Optical CV ES SES SEFS/UAS Elapsed Time
Regenerator Section Optical 1 0 0 0 0 00: 04: 34 Clear
Regenerator Section Optical 2 25723 5 4 0 00: 04: 34 Clear
Multiplex Section Near End Optical 1 0 0 0 0 00: 04: 34 Clear
Multiplex Section Near End Optical 2 1295 5 3 0 00: 04: 34 Clear
Multiplex Section Far End Optical 1 21 3 2 0 00: 04: 34 Clear
Multiplex Section Far End Optical 2 8 1 0 0 00: 04: 34 Clear

Figure 4-8 15 Mins Statistics Current



Section Select Interval Statistics

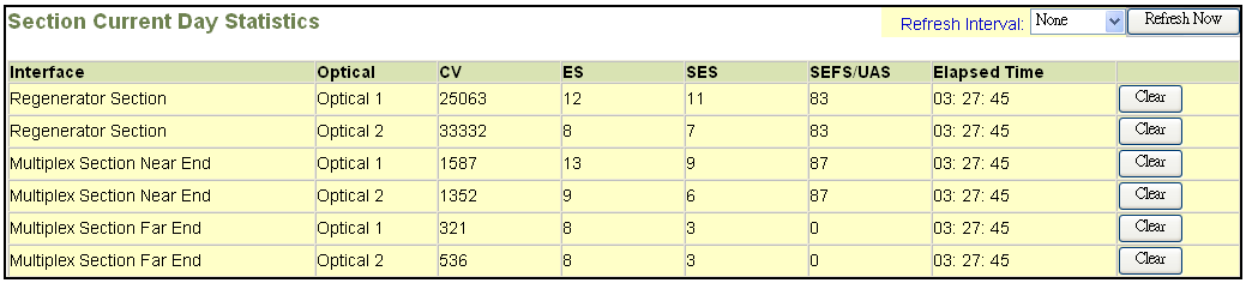
Refresh Interval: None | Refresh Now

Layer: Regenerator Section | Optical 1 | Page 1

Regenerator Section

No.	Interface	Interval No.	Valid Intervals	Optical	CV	ES	SES	SEFS/UAS	Start Time
1	RS NE	1	96	1	0	0	0	0	2007/12/10 13:57:33
2	RS NE	2	96	1	0	0	0	0	2007/12/10 14:12:33
3	RS NE	3	96	1	5248	3	3	0	2007/12/10 14:27:33
4	RS NE	4	96	1	12586	8	8	0	2007/12/10 14:42:33
5	RS NE	5	96	1	0	0	0	0	2007/12/10 14:57:33
6	RS NE	6	96	1	7229	1	0	83	2007/12/10 15:12:33
7	RS NE	7	96	1	0	0	0	0	2007/12/10 15:27:33
8	RS NE	8	96	1	0	0	0	0	2007/12/10 15:42:33
9	RS NE	9	96	1	0	0	0	0	2007/12/10 15:57:33
10	RS NE	10	96	1	0	0	0	0	2007/12/10 16:12:33
11	RS NE	11	96	1	0	0	0	0	2007/12/10 16:27:33
12	RS NE	12	96	1	0	0	0	0	2007/12/10 16:42:33
13	RS NE	13	96	1	0	0	0	0	2007/12/10 16:57:33
14	RS NE	14	96	1	0	0	0	0	2007/12/09 17:12:33
15	RS NE	15	96	1	0	0	0	0	2007/12/09 17:27:33
16	RS NE	16	96	1	0	0	0	0	2007/12/09 17:42:33
17	RS NE	17	96	1	0	0	0	0	2007/12/09 17:57:33
18	RS NE	18	96	1	0	0	0	0	2007/12/09 18:12:33
19	RS NE	19	96	1	0	0	0	0	2007/12/09 18:27:33
20	RS NE	20	96	1	0	0	0	0	2007/12/09 18:42:33
21	RS NE	21	96	1	0	0	0	0	2007/12/09 18:57:33
22	RS NE	22	96	1	0	0	0	0	2007/12/09 19:12:33
23	RS NE	23	96	1	0	0	0	0	2007/12/09 19:27:33
24	RS NE	24	96	1	0	0	0	0	2007/12/09 19:42:33

Figure 4-9 15 Mins Statistics History

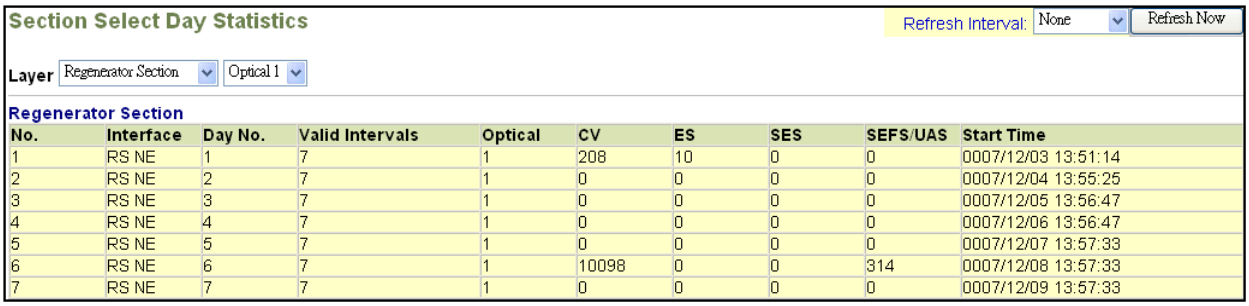


Section Current Day Statistics

Refresh Interval: None | Refresh Now

Interface	Optical	CV	ES	SES	SEFS/UAS	Elapsed Time	
Regenerator Section	Optical 1	25063	12	11	83	03: 27: 45	Clear
Regenerator Section	Optical 2	33332	8	7	83	03: 27: 45	Clear
Multiplex Section Near End	Optical 1	1587	13	9	87	03: 27: 45	Clear
Multiplex Section Near End	Optical 2	1352	9	6	87	03: 27: 45	Clear
Multiplex Section Far End	Optical 1	321	8	3	0	03: 27: 45	Clear
Multiplex Section Far End	Optical 2	536	8	3	0	03: 27: 45	Clear

Figure 4-10 Day Statistics Current



Section Select Day Statistics

Refresh Interval: None | Refresh Now

Layer: Regenerator Section | Optical 1

Regenerator Section

No.	Interface	Day No.	Valid Intervals	Optical	CV	ES	SES	SEFS/UAS	Start Time
1	RS NE	1	7	1	208	10	0	0	0007/12/03 13:51:14
2	RS NE	2	7	1	0	0	0	0	0007/12/04 13:55:25
3	RS NE	3	7	1	0	0	0	0	0007/12/05 13:56:47
4	RS NE	4	7	1	0	0	0	0	0007/12/06 13:56:47
5	RS NE	5	7	1	0	0	0	0	0007/12/07 13:57:33
6	RS NE	6	7	1	10098	0	0	314	0007/12/08 13:57:33
7	RS NE	7	7	1	0	0	0	0	0007/12/09 13:57:33

Figure 4-11 Day Statistics History

4.5 “Statistics” Main function Group Description

This section introduces the sub-functions of “Statistics” Main function. The “Statistics” main function includes “LAN RMOS” and “VCG RMON” submenus.

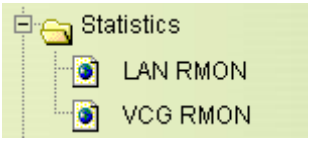


Figure 4-12 The Sub-functions of Statistics Main Function Group

4.5.1 LAN RMON

This web page allows user to check the statistics of LAN Port.

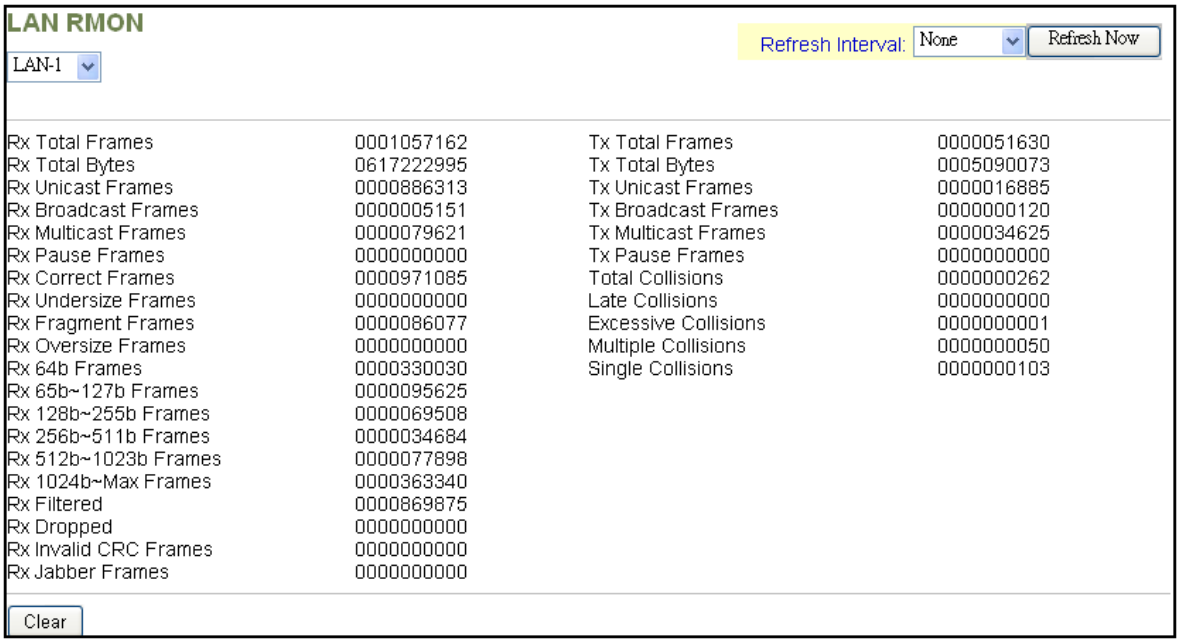


Figure 4-13 LAN RMON

4.5.2 VCG RMON

This web page allows user to check the statistics of VCG.

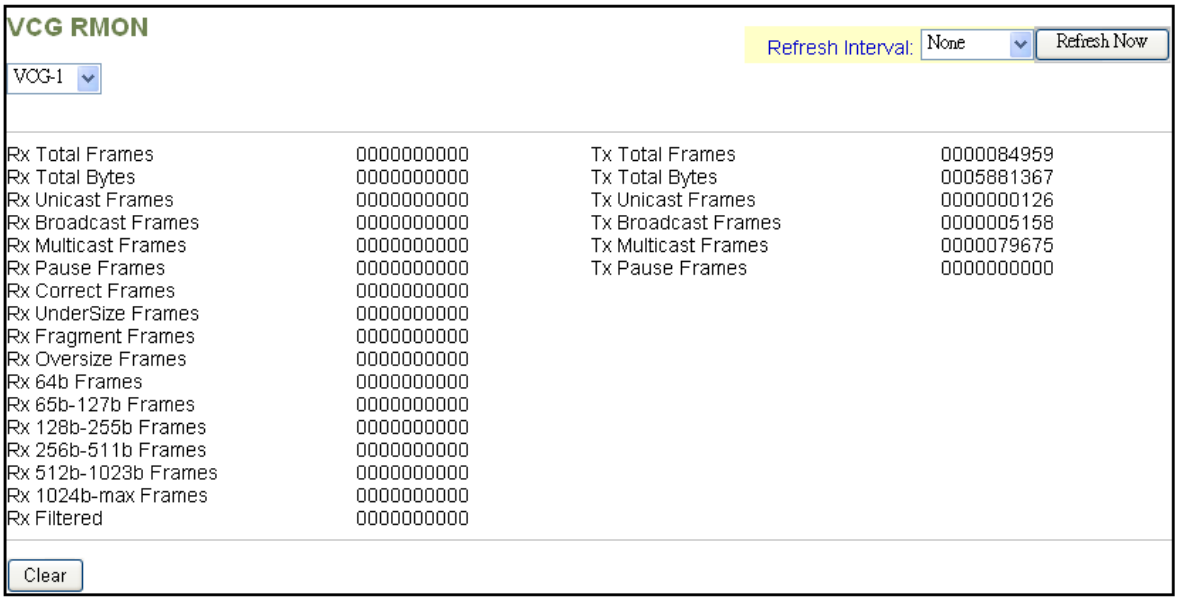


Figure 4-14 VCG RMON

4.6 “Diagnostics” Main function Group Description

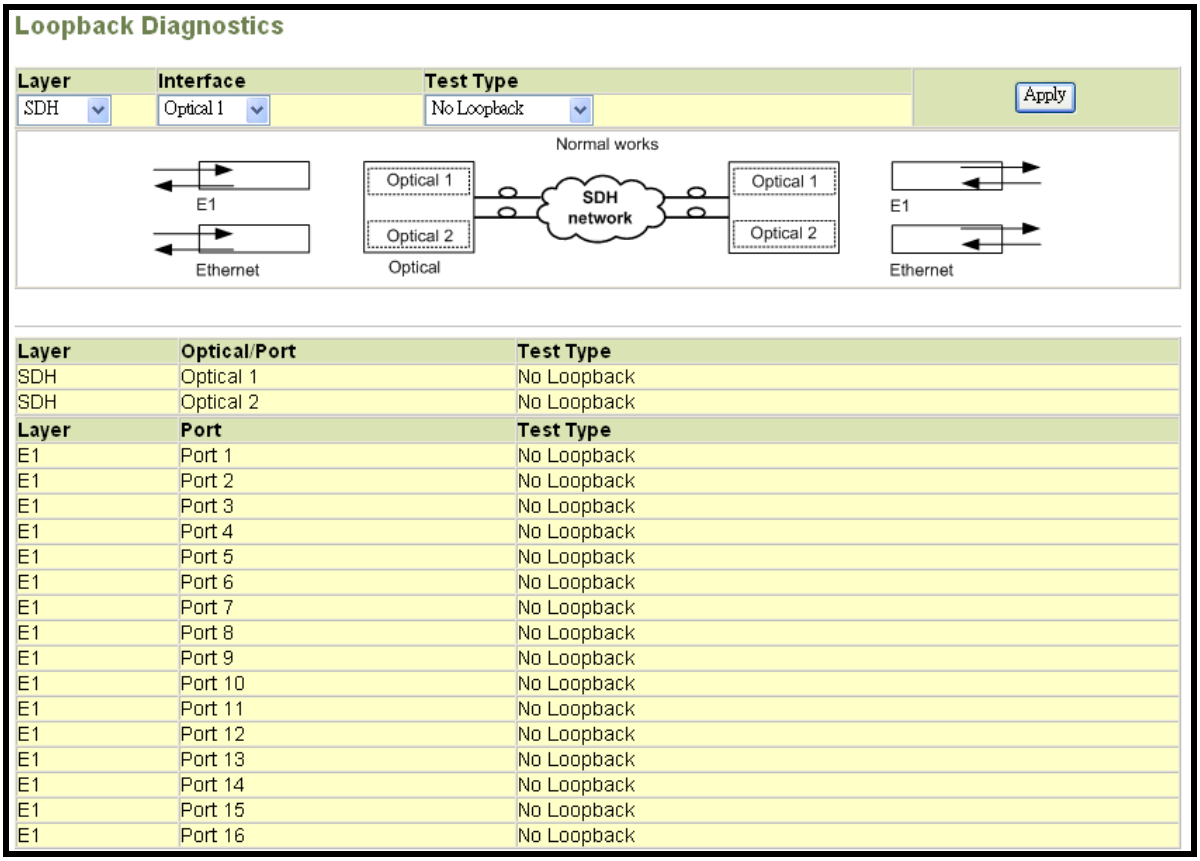
This section introduces the sub-functions of “Diagnostics” Main function. The “Diagnostics” main function has only one function “Loopback”.

4.6.1 Loopback

When the system is powered up, MUXpro Series with tributary E1 card will execute self-test procedure to check whether the card is ready or failed to initialized. Moreover, MUXpro Series will also check whether the Ethernet card is available or not.

The self-test helps to validate system’s integrity. If tributary E1 card has failed, “TRI” LED in the front panel will be flashed till the tributary E1 card returns to working stage.

The “Loopback” function allows user to test the connection except power-up self-test. User can choose which kind of the loopback to be executed.



Layer	Optical/Port	Test Type
SDH	Optical 1	No Loopback
SDH	Optical 2	No Loopback

Layer	Port	Test Type
E1	Port 1	No Loopback
E1	Port 2	No Loopback
E1	Port 3	No Loopback
E1	Port 4	No Loopback
E1	Port 5	No Loopback
E1	Port 6	No Loopback
E1	Port 7	No Loopback
E1	Port 8	No Loopback
E1	Port 9	No Loopback
E1	Port 10	No Loopback
E1	Port 11	No Loopback
E1	Port 12	No Loopback
E1	Port 13	No Loopback
E1	Port 14	No Loopback
E1	Port 15	No Loopback
E1	Port 16	No Loopback

Figure 4-15 Loopback

The MUXpro series support Optical and E1 user-controlled loopback function. Both Optical and E1 support local (analog) loopback and remote (digital) loopback.

The available test and loopback functions are described in the following paragraphs. The front panel LED (TST) of MUXpro will be ON while the loopback test is taking place.

Local Looback：

When the local loopback is activated on a selected port, it connects the port transmitting signal to the input of the receive path. The test signal is provided by the equipment, which is routed by the DXC data pump to that port. This equipment must receive its own transmission.

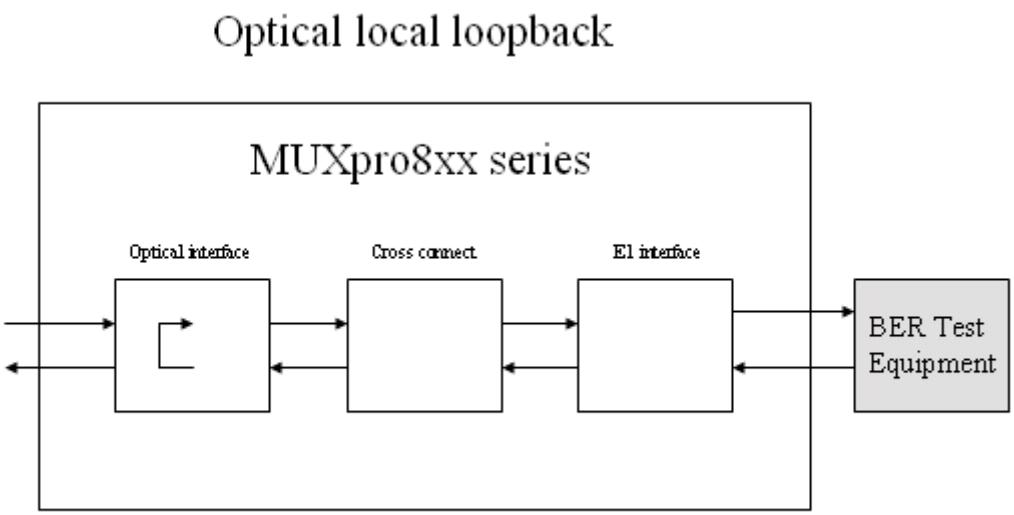


Figure 4-16 Optical Local Loopback

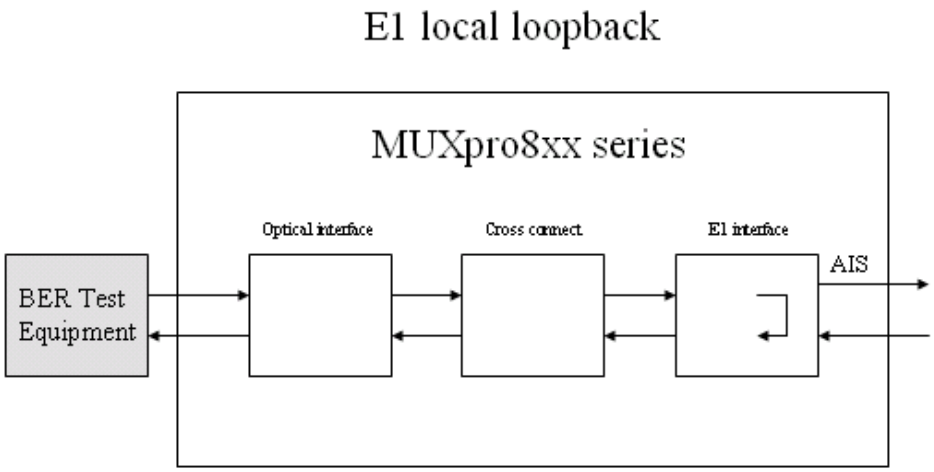


Figure 4-17 E1 Local Loopback

Remote Loopback：

When the remote loopback is activated on a selected port, it returns the received signal towards the remote user equipment connected to the same port. The remote loopback is performed by connecting the port receiving the signal, after regeneration, to the transmit path. The test signal is provided by user's equipment, which is connected to the remote end of the link, and it must receive its own transmission.

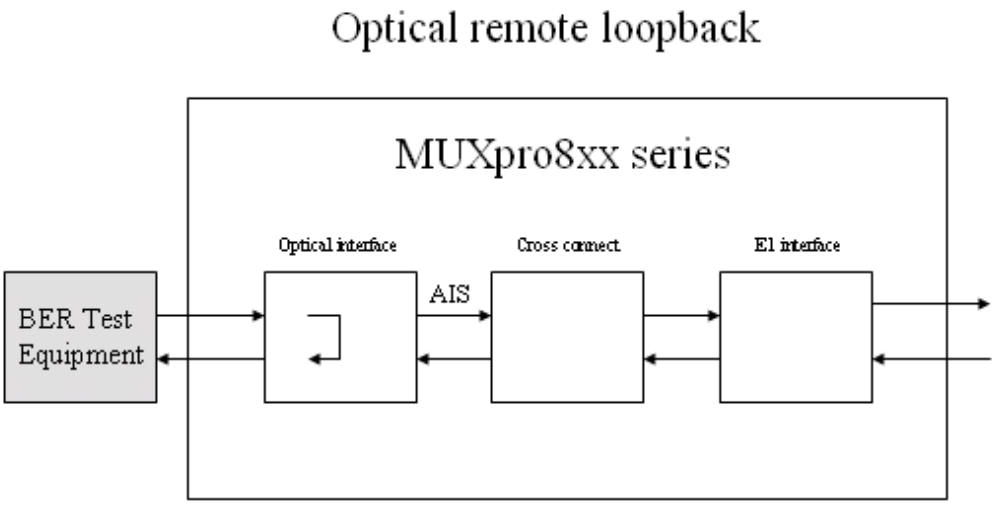


Figure 4-18 Optical Remote Loopback

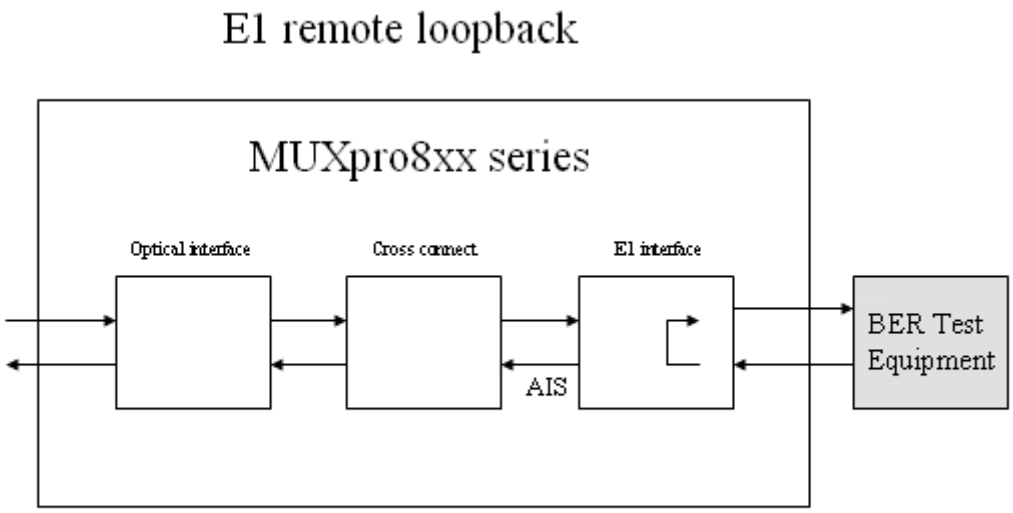


Figure 4-19 E1 Remote Loopback

Appendix A Introduction

A.1 MUXpro 820 and 8216 Craft Port (DB-9 Connector)

MUXpro 820 and 8216's Craft port use DB-9 connector, and pin descriptions for the DB-9 lists are shown in the following table. They are RS232 / V.28 electric signal interfaces.

Table A-1 Craft port pin assignment for MUXpro 820, 8216

Description	DB9 pin (male)	Source
Transmitted data	2	DTE
Received data	3	DCE
Signal ground	5	Common

A.2 MUXpro 820 and 8216 Alarm Port (DB-9 Connector)

Table A-2 Alarm port pin assignment for MUXpro 820, 8216

DB9 (female)	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
Signal	RA MAJ_A	RA MAJ_B	RA MIN_A	RA MIN_B	RV MAJ_A	RV MAJ_B	RV MIN_A	RV MIN_B	

A.3 MUXpro 820 and 8216 on Board Ethernet Port (RJ-45)

Table A-3 On-Board Ethernet port pin assignment for MUXpro 820, 8216

RJ-45	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
Signal	TPO+(o)	TPO-(o)	TPi+(i)	N/C	N/C	TPi-(i)	N/C	N/C	N/C

A.4 MUXpro 820 and 8216 E1 Interface (SCSI II, Female)

Table A-4 E1 Interface SCSI II, female pin assignment for MUXpro 820, 8216

SCSI –II pin number	Description
1/2/35/36	FGND
19/20	R_TIP7 / T_TIP7
21/22	R_TIP6 / T_TIP6
23/24	R_TIP5 / T_TIP5
25/26	R_TIP4 / T_TIP4
27/28	R_TIP3 / T_TIP3
29/30	R_TIP2 / T_TIP2
31/32	R_TIP1 / T_TIP1
33/34	R_TIP0 / T_TIP0
53/54	R_RING7 / T_RING7
55/56	R_RING6 / T_RING6
57/58	R_RING5 / T_RING5
59/60	R_RING4 / T_RING4
61/62	R_RING3 / T_RING3
63/64	R_RING2 / T_RING2
65/66	R_RING1 / T_RING1
67/68	R_RING0 / T_RING0

Appendix B Ordering Information

B.1 MUXpro 820 Order Information

Part Number	Product Code	Description
	MUXpro 820 Ethernet over SDH	
000-110-0001L	MUXpro 820F /BE/SC/A/?	10/100BaseTx Fast Ethernet over SDH device, with 8 ports on board balanced E1 interface, SC type optical fiber connector and AC power inlet.
000-110-0004L	MUXpro 820F /BE/SC/D	10/100BaseTx Fast Ethernet over SDH device, with 8 ports on board balanced E1 interface, SC type optical fiber connector and -48VDC power inlet.
000-110-0010L	MUXpro 820F/UE/SC/A	10/100BaseTx Fast Ethernet over SDH device, with 8 ports on board unbalanced E1 interface, SC type optical fiber connector and AC power inlet.
000-110-0011L	MUXpro 820F/UE/SC/D	10/100BaseTx Fast Ethernet over SDH device, with 8 ports on board unbalanced E1 interface, SC type optical fiber connector and -48VDC power inlet.
000-110-0005L	/BP8B	Back Panel, with wire-wrap connectors for 8 ports balanced E1 from SCSI connector
000-110-0006L	/BP8U	Back Panel, with BNC connectors for 8 ports unbalanced E1 from SCSI connector

B.2 MUXpro 8216 Order Information

Part Number	Product Code	Description
	MUXpro 8216 Ethernet over SDH	
000-110-0002 000-110-0002L	MUXpro 8216F /BE/SC/AD/?	10/100BaseTx Fast Ethernet over SDH device, with 8 ports on board balanced E1 interface, SC type optical fiber connector and redundant AC plus -48VDC power inlet. May order optional 8 ports E1 module separately for total up to 16 ports E1 service.
000-110-0012L	MUXpro 8216F/UE/SC/AD	10/100BaseTx Fast Ethernet over SDH device, with 8 ports on board unbalanced E1 interface, SC type optical fiber connector and redundant AC plus -48VDC power inlet. May order optional 8 ports E1 module separately for total up to 16 ports
000-110-0007L	/BP16B	Back Panel, with wire-wrap connectors for 16 ports balanced E1 from SCSI connector
000-110-0008L	/BP16U	Back Panel, with BNC connectors for 16 ports unbalanced E1 from SCSI connector
	/&	Specify additional interface module
000-110-0003L	/8E1-B	8 ports balanced E1 module
000-110-0009L	/8E1-U	8 ports unbalanced E1 module
	/?	Specify power cord
330-010-0001 330-010-0001L	/A	North American power cord, 3-pin, 10A/125V, 6 feet
330-010-0002 330-010-0002L	/E	European power cord, 3-pin (round pin), 10A/250V, 1.83M
330-010-0003 330-010-0003L	/B	British power cord, 3-pin, 10A/250V, 13A fuse

330-010-0006 330-010-0006L	/I	India power cord, 3-pin, 6A/250V, 1.83M
330-010-0007 330-010-0007L	/C	China power cord, 3-pin, 10A/250V, 1.83M

Appendix C Trouble Report

Company	
Local Representation	
Purchase Order No	
Equipment Serial No	
Software Version	
Please describe: 1. Testing Network Structure 2. Configuration 3. Testing Network Equipment 4. Trouble Description	
E-MAIL:	
TEL:	FAX:
Signature:	Date: / /

TAINET COMMUNICATION SYSTEM CORP. FAX: 886-2-2658-3232
E-MAIL: **sales@tainet.net**

Appendix D Trouble Shooting

Trouble Shooting Table		
1	Configured parameter values are lost after equipment restart	
	When user modifies or changes the parameters, the user should save the configurations in the flash memory by entering the “Save Configuration” menu, and then reboot the system by entering the “Reboot” menu.	
2	Console / Telnet / Web User Name and Password	
	When accessing the device through Telnet or the Web, the user will be prompted to enter the password. User can try the default user name “admin” and password “admin” to log in.	
3	Access denied	
	There are several conditions that will disable user’s access to the device via Console, Telnet or the Web.	
	Message	Solution
	Incorrect user	The password entered is incorrect. Check the user name and password again.

Appendix E Abbreviations

For the purpose of this recommendation, the following abbreviations are used in G.783:

Abbreviation	Description
AIS	Alarm Indication Signal
ALS	Automatic Laser Shutdown
APS	Automatic Protection Switching
AU	Administrative Unit
AUG	Administrative Unit Group
BER	Bit Error Ratio
BIP	Bit Interleaved Parity
CM	Connection Matrix
CMISE	Common Management Information Service Element
DCC	Data Communications Channel
EOW	Engineering Order-Wire
ES	Error Second
FEBE	Far End Block Error
FERF	Far End Receive Failure
HCS	Higher order Connection Supervision
HOA	Higher Order Assembler
HOI	Higher Order Interface
HP	Higher order Path
HPA	Higher order Path Adaptation
HPC	Higher order Path Connection
HPOM	Higher order Path Overhead Monitor
HPT	Higher order Path Termination
HUG	Higher order path Unequipped Generator
LCS	Lower order Connection Supervision
LOF	Loss Of Frame
LOI	Lower Order Interface
LOM	Loss Of Multi-frames
LOP	Loss Of Pointer
LOS	Loss Of Signal

Abbreviation	Description
LP	Lower order Path
LPA	Lower order Path Adaptation
LPC	Lower order Path Connection
LPOM	Lower order Path Overhead Monitor
LPT	Lower order Path Termination
LTI	Loss of all Incoming Timing references
LUG	Lower order path Unequipped Generator
MCF	Message Communications Function
MS	Multiplex Section
MSA	Multiplex Section Adaptation
MSOH	Multiplex Section OverHead
MSP	Multiplex Section Protection
MST	Multiplex Section Termination
NDF	New Data Flag
NE	Network Element
NEF	Network Element Function
NNI	Network Node Interface
OFS	Out-of-Frame Second
OHA	OverHead Access
OOF	Out Of Frame
PDH	Plesiochronous Digital Hierarchy
PPI	PDH Physical Interface
POH	Path OverHead
PSE	Protection Switch Event
RS	Regenerator Section
RSOH	Regenerator Section OverHead
RST	Regenerator Section Termination
SD	Signal Degrade
SDH	Synchronous Digital Hierarchy
SDXC	Synchronous Digital hierarchy Cross-Connect
SEMF	Synchronous Equipment Management Function
SES	Severely Error Second
SETG	Synchronous Equipment Timing Generator
SETPI	Synchronous Equipment Timing Physical Interface
SETS	Synchronous Equipment Timing Source
SF	Signal Fail

Abbreviation	Description
SLM	Signal Label Mismatch
SPI	SDH Physical Interface
STM	Synchronous Transport Module
TIM	Trace Identifier Mismatch
TMN	Telecommunications Management Network
TU	Tributary Unit
UNEQ	UnEquipped
VC	Virtual Container
ACO	Alarm Cut Off
ASW	Application SoftWare
BFW	Boot FirmWare
CIT	Craft Interface Terminal
CM	Configuration Management
FM	Fault Management
HW	HardWare
IP	Internet protocol
LU	Line interface Unit card
MIB	Management Information Base
MPU	Main Processing Unit
NE	Network Element
NM	Network Manager
OAM&P	Operations, administration, maintenance and provisioning
PM	Performance Monitoring
POST	Power-On Self-Test
RTC	Real Time Clock
SD	Signal Degrade
SF	Signal Failure
SNMP	Simple Network Management Protocol
SW	SoftWare
TCA	Threshold Crossing Alert
VCDB	Variable Configuration Data Block

Appendix F Glossary

KEYWORD	EXPLANATION
10 Base-T	Part of the original IEEE 802.3 standard, 10 Base-T is the Ethernet specification of 10 Mbps base-band that uses two pair of twisted-pair, Category 3, 4 or 5 cabling- using one pair to send data and the other to receive. 10 Base-T has a distant limit of about 100 meters per segment.
100 Base-T	Based on the IEEE 802.3u standard, 100BaseT is the Fast Ethernet specification of 100 Mbps base-band that uses UTP wiring. 100BaseT sends link pulse over the network when no traffic is present.
Address Mask	The address mask for an IP address is used to identify the boundary between the network portion of the address and host portion.
ADSL	Asymmetric Digital Subscriber Line: An evolving high-speed transmission technology originally developed by Bell-core and mow standardized by ANSI as T1.413. Uses existing UTP copper wires from Telephone Company's central office to subscriber's premises. Involves electronic equipment in the form of ADSL modems at central office and subscriber's premises. Sends digital signal up and down these copper wires and sends more information one way than the other- hence the term "asymmetric".
ARP	Address Resolution Protocol is a method to find a host's physical address from its IP address. An ARP request is sent to the network, naming the IP address, then machine with that IP address returns its physical address so it can receive the transmission.
ATM	Asynchronous Transfer Mode. International standard for cell relay in which multiple service types (such as voice, video, or data) are conveyed in fixed-length (53-byte) cells. Fixed-length cells allow cell processing to occur in hardware, thereby reducing transit delays. ATM is designed to take advantage of high-speed transmission media such as E3, SONET, and T3.

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Authentication	Proof that the information came from the user or location that repeatedly sent it. One example of authenticating software is through digital signature.
Bandwidth	This is the capacity on a link usually measured in bits-per-second (bps).
Bridging	Bridging provides LAN-to-LAN frame forwarding services between two or more LANs. Frames from one LAN are forwarded across a bridge to a connected LAN. Bridging works is similar to the way repeaters work except that bridges forward frame based on their MAC address.
CBR	Constant Bit Rate: An ATM Forum Q-o-S class created for use in ATM network. CBR is used for communications on precision clocking to guarantee trustworthy delivery.
CHAP	Challenge Handshake Authentication Protocol is an alternative protocol that avoids sending password over the wire by using a challenge/response technical.
Class A network	Part of Internet Protocol hierarchical addressing scheme. Class A networks have only 8 bits for defining networks and 24 bits for defining hosts on each network.
Class B network	Part of Internet Protocol hierarchical addressing scheme. Class B networks have only 16 bits for defining networks and 16 bits for defining hosts on each network.
Class C network	Part of Internet Protocol hierarchical addressing scheme. Class C networks have only 24 bits for defining networks and 8 bits for defining hosts on each network.
CLI	Command Line Interface: Allow you to configure TAINET'-s products with maximum flexibility.
CO	Central Office. A CO is a facility that serves local telephone subscribers. In the CO, subscriber's lines are joined to switching equipment that allows them to connect to each other for both local and long distance calls.
CPE	Customer Premise Equipment is privately owned telecommunication equipment at an organization's site that is attached to the telecommunication network. CPE equipment includes routers, modem, PBX, telephones and video communication equipment.
Crossover Ethernet Cable	A cable that wires a pin to its opposite pin, for example RX+ is wired to TX+. This cable connects two similar device, for example, two

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	data terminal equipment (DTE) or data communication equipment (DCE) devices.
DCE	Data Communication Equipment is typically a modem or other type of communication device. The DCE sits between the DET (data terminal equipment) and a transmission circuit such as a phone line.
DHCP	Dynamic Host Configuration Protocol automatically assigns IP address to clients when they log on. DHCP centralizes IP address management on the central computers that run the DHCP server program.
DNS	Domain Name System. A database of domain names and their IP address-e-s. DNS is the primary naming system for many distributed networks, including the internet.
Domain Name	The unique name that identifies an Internet site. Domain Names always have 2 or more parts that are separated by dots. Generally speaking, the part on the left is the most specific and the part on the right is the most general.
DSL	Digital Subscriber Line technologies enhance the data capacity of the existing twisted-pair wire that runs between the local telephone company switching offices and most homes and offices. There are actually seven types of DSL services, ranging in speeds form 16 K bits/sec to 52 M bits/sec. The services are either symmetric (traffic flows at the same speed in both directions) or asymmetrical (the downstream capacities higher than the upstream capacities). DSL connections are point-to-point dedicated circuits, which means that they are always connected. There is no dial-up. There is also no switching, which means that the line is a direct connection into the carrier's frame relay, ATM or Internet-connect system.
DSLAM	A Digital Subscriber Line Access Multiple-x-e-r is a network device. Usually at a telephone company central office, that receives signals from multiple customer Digital Subscriber Line connections and puts the signals on the a high-speed backbone line using multiplexing techniques. Depending on the product, DSLAM Multiple-x-e-r connects DSL lines with some combination of asynchronous transfer mode ATM, frame relay or IP networks.
DTE	Originally, Data Terminal Equipment meant Dumb Terminal Equipment. But today it is a computer, bridge or router that interconnects local area network (LAN) in increasingly more

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	intelligent ways.
Dynamic route	Also known as adaptive routing, this technique automatically adapts to traffic or physical network revisions.
Ethernet	A very common method of networking computers in a LAN. There are a number of adaptations to the IEEE 802.3 Ethernet standard, including adaptations with data rates of 10 Mbps and 100 Mbps over coaxial cable, twisted-pair cable and fiber-optical cable.
FTP	File transfer protocol: The TCP/IP protocol used for transmitting files between network nodes, it supports a broad range of file types and is defined in RFC 959.
Gateway	A gateway is a computer system or other device that acts as a translator between two systems that do not use the same communication protocols, data formatting structures, languages and/or architecture.
HTTP	Hyper Text Transfer Protocol. The most common protocol used on the Internet HTTP is the primary protocol used for web sites and web browsers. It is also prone to certain kinds of attack.
IGMP	Internet Group Management Protocol: Employed by IP hosts, the protocol that reports their multicast group membership to an adjacent multicast router.
IP	Internet Protocol. The IP (currently IP version 4), is the underlying protocol for routing packets on the Internet and other TCP/IP-based networks.
IP Pool	Internet Protocol Pool refers to the collective group of IP address locates in any particular place.
ISP	Internet Service Provider connections into the Internet for home users and businesses. There are local, regional, national, and global ISPs. You can think of local ISPs as the gatekeepers into Internet.
Jack Type	Different type of jacks (RJ-11, RJ-45 or RJ-48) can be used for an ISDN line. The RJ-11 is the most common in the world and is most often used for analog phones, modems and fax machines. RJ-48 and RJ-45 are essentially the same, as they both have the same 8-pin configuration. An RJ-11 jack can fit into an RJ-45 / RJ-48 connector, however, an RJ-45/RJ-48 cannot fit into an RJ-11 connector.
LAN	Local Area Network is a shared communication system to which many computers are attached. A LAN, as its mane implies, is limited

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	to a local area. This has to do more with the electrical characteristics of the medium than the fact that many early LANs.
LED	Light Emitting Diode. LED are visual indicators that relay information about the status of specific Scorpio 1401 / 02 functions to user by lighting up, turning off or blinking. LED-slugs are usually found on the front panel of the physical device. Examples include Status, Power and System LEDS.
LLC-Multiplexing	LLC encapsulation allows multiplexing of multiple protocols over a single ATM virtual circuit. By prefixing the PDU (Payload Data Unit) with an IEEE 802.2 Logical Link Control (LLC) header, each protocol can be identified.
Loop-reach	Loop reach defines speed that can be attained at various distances. This is very important for DSL technology as distance from the CO influences attainable speeds.
MAC	On a local area network (LAN) or other network, the Media Access Control (MAC) address is your computer's unique hardware number. (On an Ethernet LAN, it is the mane as your Ethernet address). The MAC layer frames data for transmitted as a stream of bits.
Modem	Modulator-demodulator: A device that converts digital signal to analog and vice-versa so that digital information can be transmitted over analog communication facilities, such as voice-grade telephone lines.
Name Resolution	The allocation of an IP address to a host name. See DNS.
NAT	Network Address Translation is the translation of an Internet Protocol address used within one network to a different IP address known within another network. NAPT extends the notion of translation one step further by also translating transport identifier (e.g., TCP and UDP port numbers, ICMP query identifiers). This allows the transport identifiers of a number of private hosts to be multiplexed into the transport identifiers of a single external address. NAPT allows a set of hosts to share a single external address.
Network	Any time you connect 2 or more computers together so that they can share resources, you have a computer network. Connect 2 or more networks together and you have an internet.
Node	Any single computer connected to a network.
PAP	Password Authentication Protocol (PAP) is a security protocol that requires users to enter password before accessing a security

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	system. The user's name and password are sent over the wire to a server there they are compared with a database of user account names and password. This technical is vulnerable to wiretapping (eavesdropping) because the password can be captured and used by someone to log onto the system.
Port	An Internet port refers to a number that is part of a URL, appearing after a colon (:) right after the domain name, Every service on an Internet server listens on a particular port number on that server. Most services have standard port numbers, e.g., Web servers normally listen on port 80.
Port (H/W)	An interface on a computer for connecting peripherals or device to the computer. A printer port, for example, is an interface that is designed to have a printer connected to it. Ports can be defined by specific hardware.
POTS	Plain Old Telephone Service is the analog telephone service that runs over copper twisted-pair wires and is based on the original Bell telephone system. Twisted-pair wires connect homes and businesses to a neighborhood central office. This is called the local loop. The central loop. The central office is connected to other central offices and long-distance facilities.
PPP	Point to point. PPP encapsulates and transmits IP (Internet protocol) data-gram over serial point-to-point links. PPP works with other protocol such as IPX (Internet work Packet Exchange).
RIP	Routing Information Protocol is an interior or intra-domain routing protocol that uses the distance-vector routing algorithms. RIP is used on the Internet and is common in the NetWare environment as a method for exchange routing information between routers.
Router	A device that connects two networks together. Routers monitor, direct and filter information that passes between these networks. Because of their location, routers are a good place to install traffic or mail filter. Routers are also prone to attacks because they contain a great deal of information about a network.
Server	A computer, or a software package, that provides a specific kind of service to client software running on the computers.
SNMP	System Network Management Protocol is a popular management protocol defined by the Internet community for TCP/IP networks. It is a communication protocol for collecting information from device on

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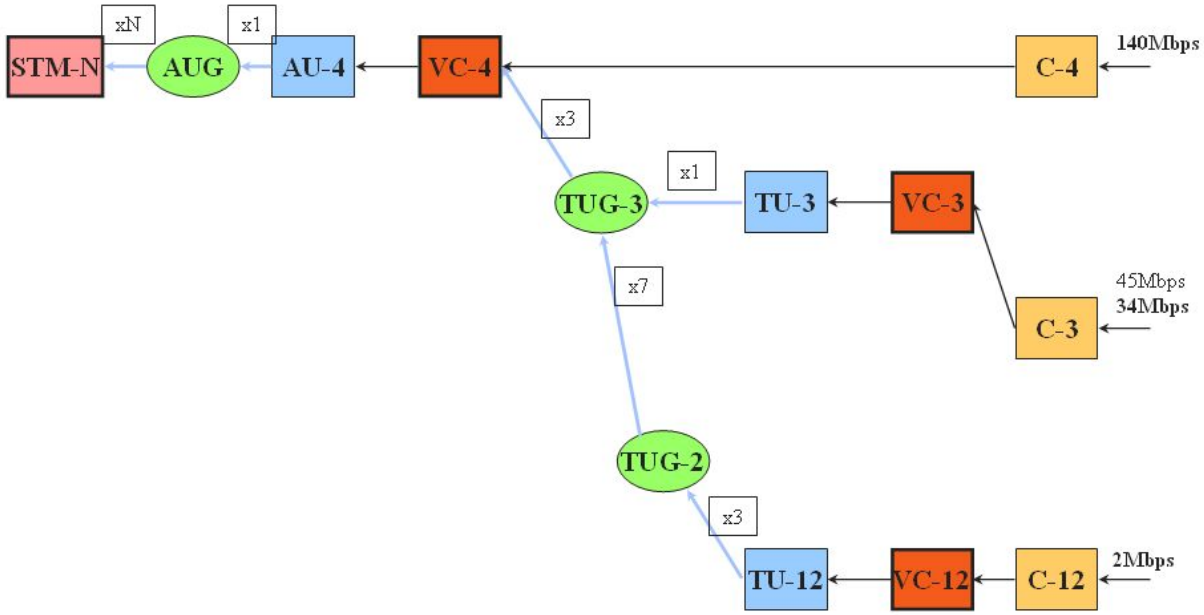
	the network.
Static Routing	Static routers tell the Scorpio routing information that it cannot learn automatically through other means. The need for Static Routing can arise in cases their RIP is disabled on the LAN or a remote network is beyond the one that is directly connected to a remote node.
VC-base multiplexing	Each ATM VC carries PDU-s of exactly one protocol type. When multiple protocols need to be transported, there is a separate VC for each protocol.
WAN	Wide Area Networks link geographically dispersed offices in other cities or around the globe. Just about any long-distance communication medium can serve as a WAN link, including switched and permanent telephone circuits, terrestrial radio systems and satellite system.

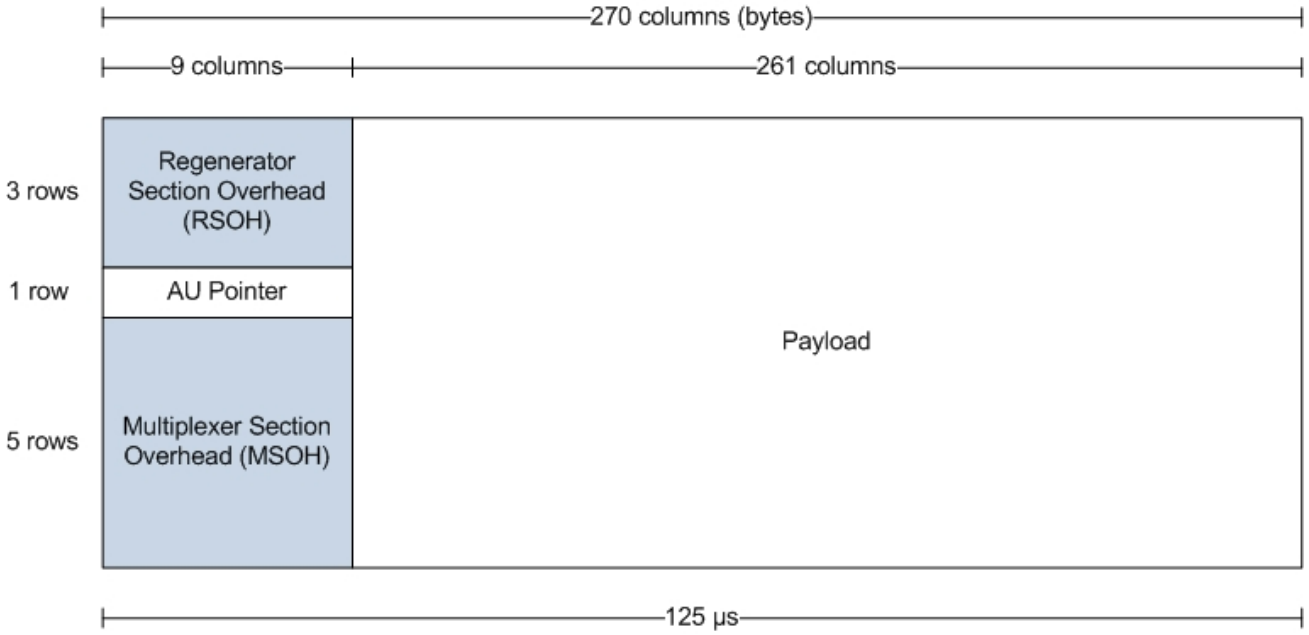
Appendix G Multiplexing Structure



MUXpro series' multiplexing structure is as above.

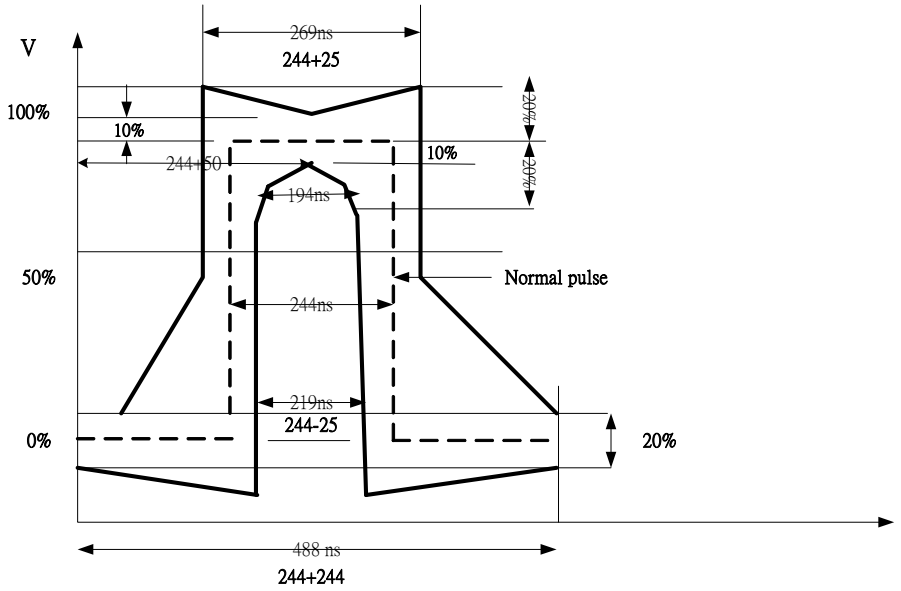
**MUXpro series do not support DS3/E3

Appendix H STM-1 Frame Structure

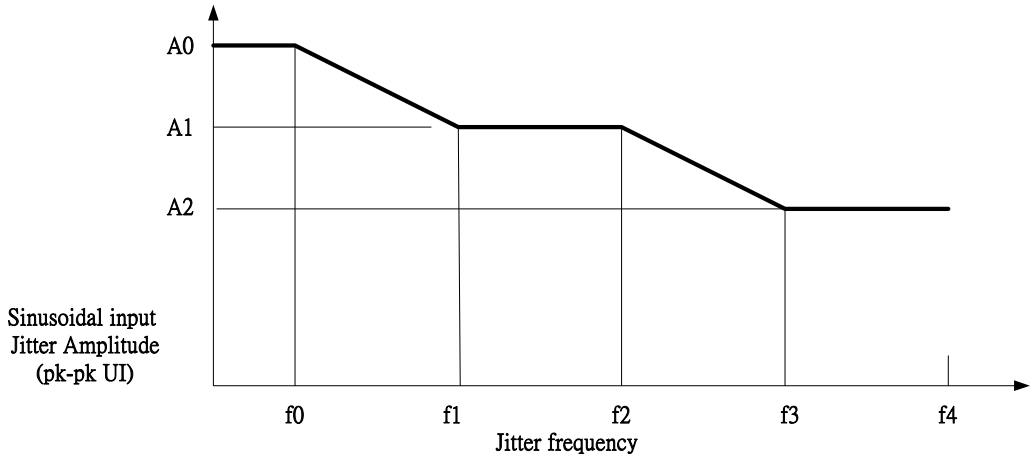


MUXpro series support standard STM-1 frame structure as above.

Appendix I E1 Shape and Jitter Tolerance



Mask of the pulse at 2048Kb/s interface



E1 Lower Limit of Maximum Input Jitter Tolerance

MUXpro series meet the standard E1 sharp and Jitter tolerance.

p-p Amplitude		Frequency			
A1	A2	F1	F2	F3	F4
1.5UIpp	0.2UIpp	20Hz	2400Hz	18KHz	100KHz